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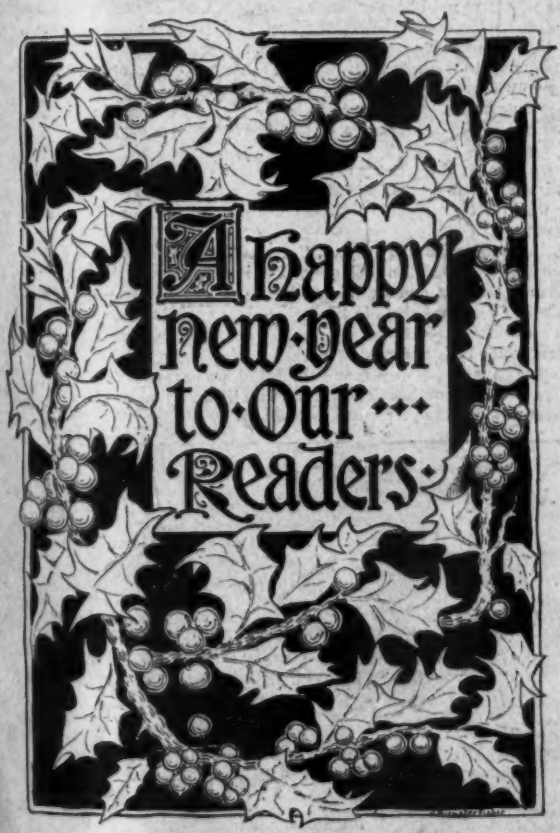

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No. 7

EDITORIAL, PUBLISHING AND ADVERTISING OFFICES OF "THE PRACTICAL TEACHER"
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THE PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW

FOR THE SCHOOL-ROOM AND THE STUDY

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THE FIRST REPORT OF THE BOARD OF EDUCATION.

FOR the first time in the history of English education, we have, within the compass of a single blue-book, and that, too, costing but sixpence, the salient facts concerning a year's progress in primary, secondary, and technical education, so far as they come under the ken of the Board of Education. It is true that the returns are somewhat belated, seeing that the figures and facts as to elementary education refer to the year ending September 1899, and those bearing upon secondary and technical education to the year ending December 1899, whilst the details as to the administrative work of the Board itself are brought up to June 1900; but this is not surprising under the circumstances of the recent institution of the Board itself, and the mass of information with which the report deals. The report is in three parts—the first being introductory and general, the second dealing with secondary, and the third with technical education.

PART I.—GENERAL.

The organisation of the office and other items affecting the Board are first referred to when we come to the question of the **inspection of secondary schools**, and we are not surprised to learn that there is no rush for the privilege of being examined; which is due, in the opinion of the Board, to the fact that the schools have been "awaiting the completion of the necessary arrangements by this Board."

A Pedagogic Library.—For the behoof of the inspectors and other officers of the Board, a special reference library of books bearing on educational systems throughout the civilised world has been got-together—a step altogether worthy of commendation.

New Science Inspectors.—To make the inspection of science schools and classes more thorough, there has been considerable addition to the staff of inspectors of science, and further appointments are under contemplation.

The New Code.—The codal changes, which were fully dealt with in our April number, are touched upon in the report; and everybody will join in the hope that "a higher level of general education" will result, "without imposing any additional burden on teachers and children."

The Higher Elementary School Minute.—With respect to the Higher Elementary Minute of April 6, 1900, concerning which there is so much just dissatisfaction, it would be startling to read that the "curriculum will be such as to embrace in the higher classes the work of the elementary course prescribed for schools of science," did we not know that this indefensible construction had been placed upon the minute in the replies sent to the School Boards throughout the country.

However the members of the Cabinet who are responsible for this obstruction of higher primary education, other than scientific, hope to justify themselves in the eyes of their countrymen and to their own consciences, passes the wit of common men. Certainly they will have to pay dearly for their folly if they do not speedily include what should be a first consideration to a nation of shopkeepers—namely, commercial education. Judging from the half-dozen lines in the report, the day of repentance is not yet.

Superannuation.—Turning to the section dealing with the Superannuation Act, we note that 2,960 men and 14,972 women have refused the miserable pension a grateful Government offers them; and however much we may regret this—since it will tend to make matters worse instead of better—we are not surprised; and when the Superannuation Committee of the Executive glow with pride at the realisation of a pension scheme, it will perhaps have a chastening effect upon them that more than a quarter of existing teachers have preferred not to accept the miserable pittance upon which old age must almost starve.

The number of pensions taken up in the first year was 132 for men and 62 for women; the total amount spent for the year being £6,304, 4s. 2d., or an average of about £32, 10s.

Extension of time was granted to 92 persons—that is, nearly a third of those eligible for superannuation begged to go on teaching. And again we say, No wonder!

Disablement allowances, the one bright spot in the scheme, were awarded to 79 men and 87 women.

Voluntary Schools.—The associations of these schools for the

Next Month:

MR. SADLER'S NEW VOLUME OF SPECIAL REPORTS.

purposes of the allocation of the Special Aid Grant have grown apace, there being now only 201 schools outside the pale. As respects the solvency of these schools, it is satisfactory to read that, whereas they were £188,545 on the wrong side in 1898, this has now been reduced to £90,421. On the improvement of teaching power, £370,166 of the grant was spent; and on school equipment, £182,144.

Tables are given showing that the expenditure in salaries in 1898 was 10 per cent. greater than in 1897, and that the expenditure on books was greater by 54 per cent. in the latter of these two years as compared with the former. Still, when it is recorded that the average salary of a London Board head-master is £291, 6s. 7d., whilst his voluntary brother, often equally well qualified in every way, has to be content with an average salary of £167, 1s. 4d. —the figures for women being £204, 9s. 3d., and £100, 7s. 11d.—the need for a national system of education is pretty evident, at least from the standpoint of the teacher who pays the piper without being allowed to call the tune.

Voluntary Subscriptions.—It is satisfactory to notice that an upward tendency is again observable in this source of voluntary school income, the amount contributed in 1899 being £771,964, as compared with £757,862 in 1898 and £834,017 in 1897. We commend the action of the Board in refusing to allow the Special Aid to be gobbled up by greedy managers as an increased rent charge; and we venture to assert that a little more vigilance will enable a further saving to be made under this head.

The Robson Act of 1899.—Two points are worthy of note here. In the first place, the law officers of the Crown have decided "that the partial exemption which the child is (at the age of twelve years) entitled to obtain is partial exemption as defined by the by-laws of the place in which the child resides; and that it is subject to such conditions as to employment as those by-laws may contain." Secondly, there does not appear to have been the rush for the special agricultural clause, which local authorities may, unfortunately, insert in their by-laws, that was justly feared. According to the report, "it is too soon to say positively to what extent the local authorities are availing themselves of their power to make a special by-law for children employed in agriculture." We hope that later information will bear out our anticipation of self-denial on the part of attendance authorities with respect to this questionable privilege.

Blind, Deaf, Defective, and Epileptic Children.—The two paragraphs relative to the progress made in specially catering for these unfortunates afford just cause of congratulation that the good work is being well attended to.

Children on Canal Boats.—The returns, admittedly incomplete, show that 1,390 children of school age are known to be resident upon canal boats, and are also known to be successfully dodging their education, for the School Boards having most to do with this class of absentee are "subsiding into the inaction of despair." But when the canal child blossoms into the Hooligan, as is most natural, considering his surroundings, he will be held up as an awful example of the effects of the godless School Board education.

Part II.—Secondary Education.

Under this head come particulars as to instruction in science and art, and in technical subjects, details concerning national museums, and some account of the work done by the Geological Survey and the Solar Physics Observatory. The information is somewhat voluminous, but for our purpose it may be briefly dealt with.

Clause VII. Authorities.—It is recorded that twenty-eight of the forty-nine administrative counties, and twenty-one of the sixty-one county boroughs, have been duly accepted as the Local Authority having control of science and art instruction connected with South Kensington within their borders. A list of these county authorities is given in Vol. II. of the Report.

Science Classes, Science Schools, and Schools of Science.—The following table gives information respecting the number of schools and classes, and the students in attendance thereat, during the past two years:—

Year.	No. of Schools.	No. of Classes.	Students eligible for Grants.
1898.	2,023.	11,723.	158,370.
1899.	2,056.	12,580.	174,670.

In 1899 the number of schools of science was 169, with 23,450 students, as compared with 159 schools and 21,193 students in the preceding year. No particulars are given as to the schools of science that have been compelled to suspend operations by reason of the action of the Board of Education, although this would have been an interesting piece of information.

The success of science students at the South Kensington examinations may be judged from the following paragraph:—"In 1899 examinations were held in 2,086 centres in the provinces, and at 175 in the metropolis. Of the papers worked, 113,846 were in the elementary stage, and 39,888 in the advanced stage—the number of first classes in each stage being respectively 35,668 and 5,651; while the number of papers in the honours division of the examination was 2,882. Of these 20 passed in the first class and 55 in the second class of Part II.: 43 passed in subjects where honours was not divided into parts, and 843 passed in Part I."

Finance.—For the year 1899 the grants to science schools and classes in the three kingdoms totalled up the sum of £96,285, 4s. 3d., as compared with £86,476, 16s. 1d. for 1898, being an average of 12s. 8¾d. for each science student, and £4, 4s. 3d. for each student in a school of science. The examiners' reports on the papers worked are given *in extenso;* but as they have already been circulated amongst teachers, and have been dealt with in our Science Section, we need do no more than merely refer to them here, nor shall we give details as to the Royal College of Science and the Summer Courses for Students.

Art.—Particulars corresponding to those given respecting instruction in science are supplied with respect to art, but we think it will be more interesting to utilise the space at disposal by giving some expressions of opinion, showing how little the art inspectors are impressed with the work done in design, both at the Royal College of Art and at the various art classes throughout the country. Manufacturers complain that they can get no suitable and practicable designs from the National Art School; which complaint is amply justified by the reports of the examiners, as will be seen from what follows.

Wall Papers.—"The examiners are sorry to see how relatively few of the better designs even could be executed by the ordinary methods of manufacture without modification." And again, "The examiners regret to note a conspicuous absence of good draughtsmanship."

Book Illustrations.—"The average of the work is decidedly below that of last year."

Designs for Colour Prints.—"In this subject there is a very poor show of work, the designs being almost all unsuited for colour printing. Too many colours are introduced, as well as incidental effects, which could only be reproduced at a prohibitive cost."

Designs for Posters.—"The designs for posters submitted from the Royal College of Art fall far below the standard required for national competition awards."

Carpets.—"The designs are generally not interesting, and are generally below the average."

These are a few of the comments that seem to indicate a painful weakness in the most desirable of qualities in a design to be worked up in the factory—namely, suitability with respect to the process.

Part III.—Elementary Education.

Attendance.—The question of attendance naturally comes first in this section of the report. The table that follows will give full particulars under this head for the years 1898 and 1899:—

		On Register.	Average.	Percentage.
1898.....	Infants.....	2,012,623	1,424,839	70·79
	Older scholars.	3,564,243	3,129,326	87·79
	Total	5,576,866	4,554,165	81·66
1899.....	Infants.....	2,032,261	1,464,494	72·06
	Older scholars.	3,621,831	3,172,444	87·59
	Total.....	5,654,092	4,636,938	82·01

BRITISH MUSEUM

Free and Fee Schools.—There are now in England and Wales 17,248 free public schools, and 4,983,810 free scholars. There remain only 91 schools (as compared with 95 in the preceding year) which refuse the fee grant. The number of schools which, while receiving the fee grant, continue to charge such fees as the law allows, has fallen from 2,834 to 2,725. The number of fee-paying scholars in all classes of elementary day schools has declined from 706,251 in 1898 to 670,282 in 1899.

Leakage.—It is assumed that one-fifth of the population consists of children of school age. This gives a school population of 6,348,517, of which it is estimated that 4,986,562 should be of the class usually found in elementary schools; but as the number on the roll for 1899 was only 4,759,872, it follows that about 5 per cent. of the children who should be in the primary school are not there.

The two tables subjoined show what the average grant is for both infant schools and for schools for older scholars for both 1898 and 1899:—

1. Infants' Schools.

	1898.	1899.
	s. d.	*s. d.*
Fixed grant	8 11¾	8 11¾
Variable grant	5 5	5 3½
Needlework and drawing	1 0	1 0
Singing	0 11½	0 11½
Total	16 4¼	16 3

2. Schools for Older Scholars.

	1898.	1899.
	s. d.	*s. d.*
Principal grant	13 7¾	13 7
Discipline and organisation	1 5¾	1 5¾
Drawing	1 0½	0 3¼
Needlework	0 3½	0 3
Singing	0 11½	0 11¼
Class subjects	3 9¼	3 8¾
Specific subjects	0 2¾	0 2½
Cookery	0 3	0 2¾
Laundry work, Dairy work, Cottage gardening	0 0¼	0 0¼
Manual instruction	0 2	0 0½
Total	21 10¼	20 9

Evening Continuation Schools.—While the total number of scholars in the evening continuation schools has increased during the year under review from 435,600 to 474,563, the number of those among them who paid no fees rose from 166,754 to 237,272. Of the fee-paying scholars the great majority pay from 1d. to 3d. per week. The three R's are more taught than any other subject in the evening schools—needlework, shorthand, geography, vocal music, book-keeping, mensuration, commercial arithmetic, and domestic economy following next in the order named, after which come various other subjects with but a small number of students. The total grant paid by the Education Department for 1898 was £188,763, 3s. 10d., which decreased to £180,852 in 1899, to which, however, must be added £2,854, 5s. that was paid by the Science and Art Department in this latter year. An increasing number of adults is to be found every year in these useful institutions.

Teachers.—The most striking feature under this head is the increasing proportion of women as compared with men teachers to be found in our schools. Thirty years ago the proportion was 52 per cent. men to 48 per cent. women. At the time of making up these returns the figures were 39 per cent. men to 61 per cent. women. When we regard the pupil-teacher supply, the same disproportion between the sexes is encountered to an even more striking degree, only 20 per cent. of the apprentices being boys. It does not appear that teaching is sufficiently attractive as a profession to entice the male portion of young England to enter it. Nor will this undesirable state of affairs change until the condition of the class master is greatly improved both financially and socially—a fact that School Boards and school managers throughout the country will do well to digest.

The average salary of a certificated master is £125, 13s. 6d., that of a schoolmistress is £84, 13s. 6d.; but the two tables appearing below clearly prove that very many certificated masters and mistresses are working for what cannot, in any sense of the word, be called a living wage.

Certificated Masters.

	Number and percentage in receipt of Salaries of									
	Under £50.	£50 and under £100.	£100 and under £150.	£150 and under £200.	£200 and under £250.	£250 and under £300.	£300 and under £400.	£400 and under £500.	£500 and over. *	Total.
Principal	14 ·10	2,892 21·96	5,525 43·48	2,543 17·79	1,211 9·20	519 3·93	434 3·30	25 ·19	6 ·05	13,169 —
Additional	32 ·30	5,804 55·36	3,354 31·98	1,280 12·21	13 ·13	1 ·01	1 ·01	— —	— —	10,485 —

* Namely—Three between £500 and £600, one between £600 and £700, one between £700 and £800, and one between £900 and £1,000.

Certificated Mistresses.

—	Number and percentage in receipt of Salaries of										
	Under £25.	£25 and under £50.	£50 and under £75.	£75 and under £100.	£100 and under £125.	£125 and under £150.	£150 and under £200.	£200 and under £250.	£250 and under £300.	£300 and under £400.	Total.
Principal	2 ·01	251 1·44	6,041 34·86	5,553 32·03	2,689 15·52	1,213 7·00	900 5·19	555 3·20	113 ·65	16 ·10	17,333 —
Additional	30 ·15	1,293 6·61	9,327 47·69	5,050 25·82	2,810 14·37	1,035 5·29	10 ·05	2 ·02	— —	— —	19,557 —

"Untrained."—We are glad to see that a modicum of justice is meted out to the non-collegiate teacher, who constitutes 28 per cent. of the men and 50·9 per cent. of the women certificated teachers of the country. The report truly says that "a considerable portion cannot, except in a technical sense of the word, be classed as *untrained*, as they have passed through the pupil teacher's course under the superintendence of some of the best teachers, and have served as assistants in large schools, before passing the examination for a certificate and undertaking independent charges." The term is not only a misnomer, but a libel, and the Board of Education would only be rendering a simple act of justice if they dropped the term altogether, and replaced it by the more appropriate "independently trained," which really describes these 19,248 certificated mistresses and these 6,817 certificated masters.

Side Entrances.—In the year ended December 31, 1899, seventeen graduates were recognised as certificated teachers under Art. 60 (*b*) of the Code of 1899, and four trained teachers, certificated in the first class by the Irish Commissioners of Education, were recognised as certificated teachers under Art. 60 (*c*). Forty-seven students were admitted for one year's training under Art. 115 (*b*), and ten under Art. 115 (*c*); and eighty-four men and sixty-two women received a third year's training. The total number of provisionally certificated teachers now in charge of schools is forty-six—namely, four men and forty-two women.

Mr. Sharpe's "Animated Broomstick."—The teacher under Art. 68, whose only qualification has been quaintly described as the possession of a vaccination certificate, now numbers 16,717, an increase in the last six years of 8,183, or of nearly 96 per cent.—a fact to which the Board calls special attention, moved thereto, we hope, by the feeling of shame which all well-wishers of popular education must feel when reflecting that some three or four hundred thousand of our children are in the hands of unskilled and almost illiterate teachers.

Thus far we have, crudely and imperfectly, it is true, drawn attention to some of the facts concerning popular education upon which we may congratulate ourselves, and upon others which should bring a feeling of shame in their wake, as showing how imperfectly as yet we perform the most urgent of all national and patriotic duties—namely, the education of our future masters.

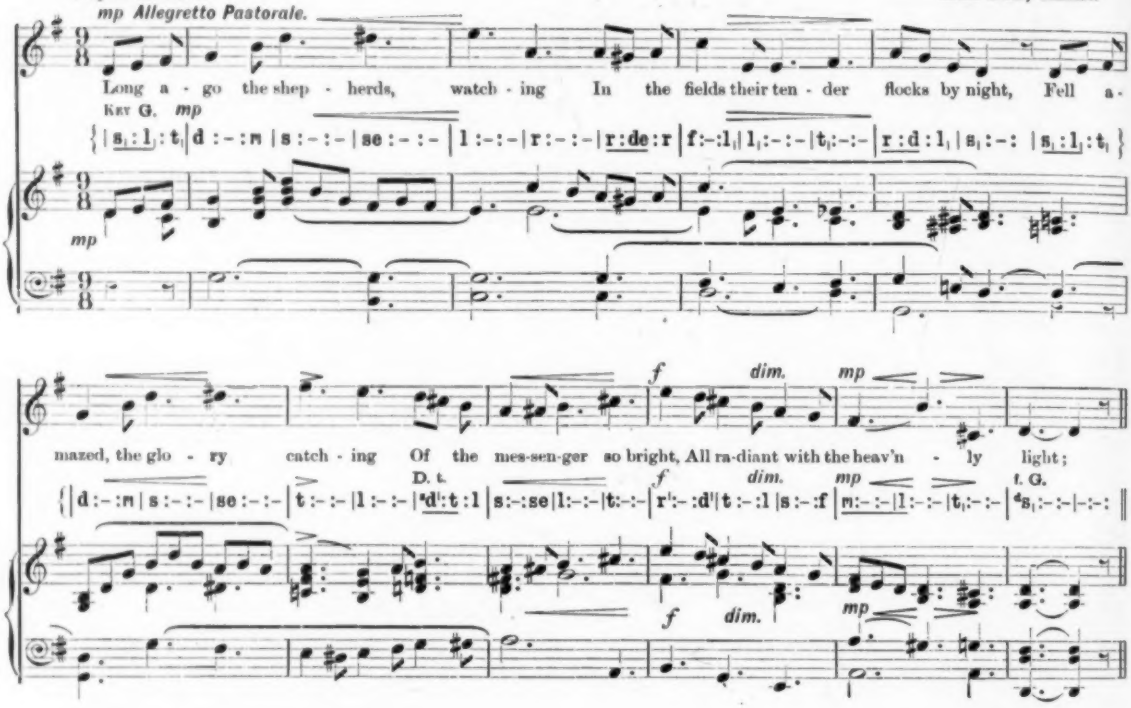
A CHRISTMAS CAROL.

Words by HUBERT E. CLARKE.

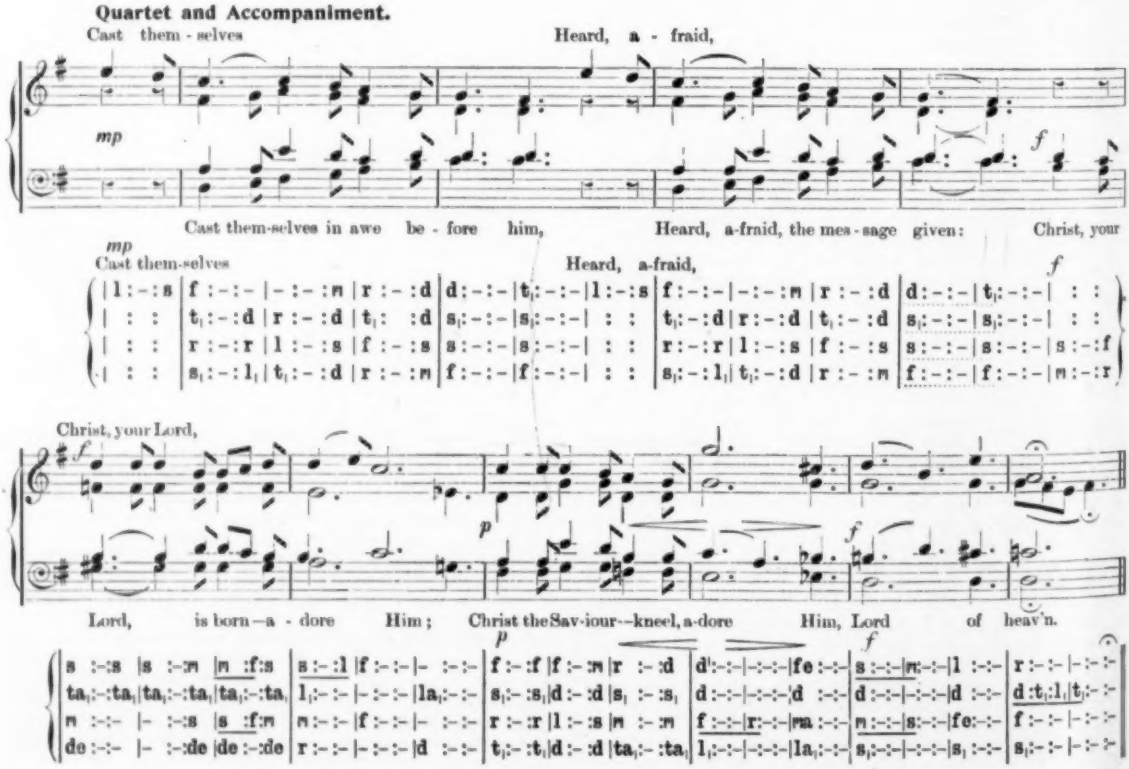
Music by RALPH DUNSTAN, Mus. Doc., Cantab.

Soprano Solo.

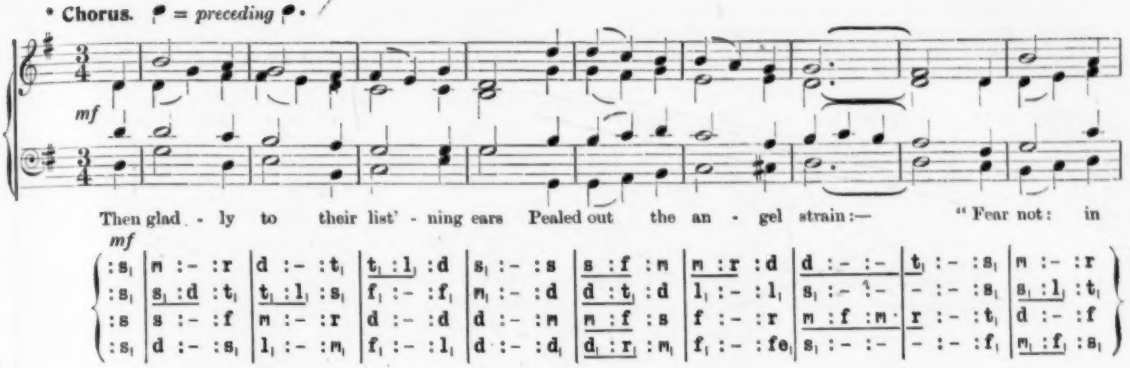
mp Allegretto Pastorale.


Long a - go the shep - herds, watch - ing In the fields their ten - der flocks by night, Fell a-
KEY G. mp
mp
mazed, the glo - ry catch - ing Of the mes-sen-ger so bright, All ra-diant with the heav'n - ly light;
D. t.
f dim. mp
t. G.
f dim. mp

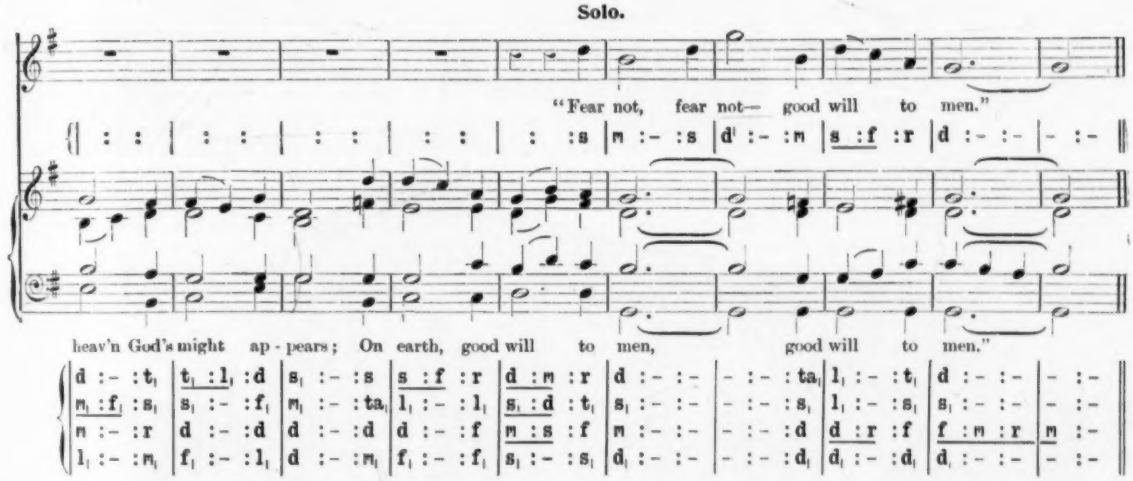
Quartet and Accompaniment.



* **Chorus.** 𝄐 = *preceding* 𝄐.



Solo.



1. Long ago the shepherds, watching
In the fields their tender flocks by night,
Fell amazed, the glory catching
Of the messenger so bright,
All radiant with the heavenly light;
Cast themselves in awe before him,
Heard, afraid, the message given:
Christ, your Lord, is born—adore Him;
Christ the Saviour—kneel, adore Him,
Lord of heaven.
Then gladly to their listening ears
Pealed out the angel strain:—
"Fear not: in heaven God's might appears;
On earth, good will to men."

2. Forth they set to find the manger
Where in swaddling clothes the babe was laid—
He, earth's mighty, lowly stranger,
Who His Father's will obeyed,
And anger's righteous justice stayed.
Found Him, worshipped, and the story
Of His coming spread abroad.
God the Christ—O wondrous story;
Christ, Redeemer—sound His glory,
King and Lord.
So through the changes of the years
Still rings the gladsome strain:—
"Fear not: in heaven God's might appears;
On earth, good will to men."

3. We, to-day, will greet the dawning,
And with joy the wide earth-music swell;
Hymning sweet Redemption's morning,
Forth in choirs His honour tell,
Who came as man with us to dwell.
Ring, ye bells, the Saviour praising;
Sound, ye organs, solemn strain;
Sing, ye choirs, your voices raising,
Sing on high, His name upraising—
Sound again.
ppp While softly to our listening ears
Peals out the angel strain:—
"Fear not: in heaven God's might appears;
On earth, good will to men."

* The well-known melody employed in this Chorus is attributed to Samuel Webbe, and also to Mozart.

POLYTECHNICS AT HOME AND ABROAD.

THE TECHNIKUM AT WINTERTHUR IN SWITZERLAND.

THIS important school for Technical Instruction was opened on May 4, 1874. It comprises the following sections:—

1. Building (Civil Engineering). 2. Mechanical Engineering. 3. Electrical Engineering. 4. Instrument-making. 5. Chemistry and Dyeing. 6. Industrial Art. 7. Surveying and Agricultural Engineering. 8. Commerce. 9. Railway Service.

The scholastic year is divided into a summer term, beginning on the third Monday in April and ending about the 10th of August; and a winter term, beginning on the first Monday in October and closing about the end of March, with a break of ten days at Christmas. The first day of each term is given to entrance examinations. Boys and girls applying for admission must have completed their fifteenth year; the letters of application must be written by themselves; a written consent of the father or tutor-at-law, a certificate of birth, school testimonials (eventually testimonials of apprenticeship), and a certificate of good conduct must be enclosed. Those applying for the railway-service section are, moreover, to produce a medical certificate by one of the railway companies' physicians. School fees—30 francs (£1, 3s. 9½d.) per term for Swiss pupils and for foreigners whose parents live in Switzerland, 60 francs (£2, 7s. 7d.) for other foreigners. Auditors attending only a limited number of lessons pay 2 francs (1s. 7d.) per term for the weekly lesson: for instance, an auditor attending ten lessons a week has to pay 20 francs (15s. 10d.) per term. In addition, a small contribution is raised for the use of the laboratories. As a reward for good conduct and work, pupils of parents with small income may be freed from all fees; exhibitions and scholarships are also allotted to them by the cantonal government. In the higher classes of the commercial section, additional exhibitions may be obtained from the Confederation. In the winter term 1899–1900, forty-six pupils were exempt from school fees; seventy-one pupils enjoyed the same facilities, and in addition received purses to the total amount of 7,130 francs (£282, 14s. 3d.). Poor pupils also get drawing materials gratis, and are permitted the use of drawing utensils, boxes of mathematical instruments, etc., free of charge. At the end of each term certificates are given out, a public exhibition of the pupils' drawings and written work is arranged, and public repetition courses on subjects treated during the term are held. When a pupil has passed all the classes of his section, he may apply for a diploma, which will be awarded to him after having successfully passed the final examinations.

There is no boarding-house connected with the school; the pupils live with thoroughly respectable families in the town, and the head-master of the school is always prepared to advise parents on this point. Board and lodging cost from 60 to 100 francs (£2, 7s. 7d. to £3, 19s. 3½d.) a month, according to the conveniences required. The Swiss pupils, as a rule, enter the Technikum after having previously gone through six years of primary and three years of secondary instruction. All the applicants, whether Swiss or foreign, must undergo the entrance examination in the following subjects:—

German language—an easy composition; French language (compulsory for the commercial and railway-service sections only)—Grammar, including the most frequently used irregular verbs, an easy translation from the German; arithmetic—fractions (common and decimal), simple interest, proportion; algebra—square root, simple equations; geometry—measurement of area and solidity; geometrical drawing—use of instruments, easy constructions; freehand drawing—some skill in outlining from copy (the last two subjects being compulsory for the technical sections only).

THE TECHNIKUM.

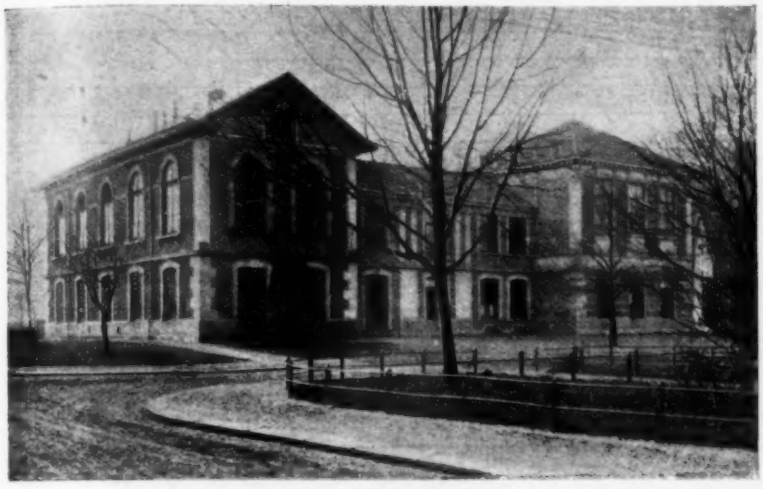
The first section (Building) comprises five terms. The pupils learn to do the calculating, sketching, and drawing of all the various constructions applied in civil engineering, so as to be able to act as builders' overseers, or rationally conduct any builder's trade.

The section for Mechanical Engineering (six terms) prepares men for intermediate positions between the simple machine drawers and the leading engineers. It secures to the pupils a marked superiority over the mere routinists in machine building. Excellent foremen are formed here. The sons of manufacturers, mill-owners, etc., are enabled to study and judge for themselves the machines best fitted for the work required. Special courses for spinning and weaving also form part of the syllabus of this division.

In a similar manner, the section for Electrical Engineer-

ing (six terms) provides for the demand of theoretically and practically well-instructed electrotechnic fitters and mounters.

In the division for Instrument-making (four terms), young



SECTION FOR CHEMISTRY CLASSES.

men who have already in an apprenticeship acquired the necessary manual skill are supplied with theoretical knowledge for the construction of scientific implements and apparatus, surveying instruments, etc. They become the foremen and masters of their respective industries.

The section for Chemistry (six terms) begins by giving a thorough knowledge of the subject generally, and then branches off into the special requirements of bleaching, finishing, dressing, dyeing, printing. Some pupils successively pass through the sections for mechanical engineering and for chemistry, especially those connected with the manufacture of paper, leather, cement, and bricks.

Land Surveying and Agricultural Engineering (six terms) are taught so far as to enable the pupils who at the end of their course of study win the diploma to enter the civil service without any further examinations.

The Industrial Art classes (five terms), while paying due attention to general skill in drawing and modelling, more especially teach decorative painting, ceramics, staining of glass, sculpture, and graphic multiplying methods. Teachers of freehand drawing are also prepared for their profession in this department.

The commercial section (six terms), which, like the one before mentioned, is also frequented by young ladies, devotes most of the time to foreign languages (French, English, Italian, and Spanish), commercial arithmetic, correspondence, and book-keeping. Political economy, commercial law, technology, come next in importance. These courses are not only attended by future merchants, but also by those preparing for entering the postal service of the Confederacy.

The Railway Service section (four terms), only recently established, prepares in a similar way young men for their future calling.

Excursions (with the aim of technical instruction) are regularly made, under the guidance of professors, by all sections. In 1899 some of them even extended to Germany and France. The cantonal and federal governments also send the professors on tours of research. The school has a large library and a well-assorted technical museum, both of which increase every year, not only by government subsidies, but also by numerous presents, partly from manufacturers whose sons have gone through a course of study at the Technikum.

A novel feature of the school is the insurance of all the pupils against illness and accidents; the premium to be paid per term and pupil is 3 francs (2s. 4½d.), the maximum time of gratuitous medical treatment being four months.

For the year 1899 the total expenditure of the school amounted to £10,226, of which sum £1,379, 15s. 10d. was spent for increasing the collections of the technical museum.

The expenses were covered as follows:—

Subsidy of the Federal Government	£2,865	14	0½
Subsidy of the Cantonal Government	5,014	2	1
Subsidy of the town of Winterthur	713	14	4½
School fees	1,632	9	6
Total	£10,226	0	0

In 1874 the Technikum opened with 72 pupils, and since then the number has steadily increased. The last report shows 710 pupils and 47 auditors—total, 757. Foreign pupils generally make up about one-seventh of the whole number, and they hail from all the civilised countries of the world. At present, pupils from Germany, Russia, France, Italy, Austria, Hungary, Roumania, Turkey, Belgium, Holland, America, and Natal are to be found on the roll. In 1874 the teaching staff consisted of 9 professors, against 41 now.

Oxford University Statistics.—In the *Calendar* for 1901 issued by the Oxford University Press, and published by Mr. Henry Frowde, the number of undergraduates is given as 3,499, there being 6,258 members of Convocation and 13,136 members on the college books. The last total may mislead if it is not borne in mind that many members have their names on the books of more than one society. A year ago the figures were respectively 3,446, 6,220, and 12,968. The matriculations in 1899 numbered 856, or 42 more than in 1898; there were 355 Masters of Arts, or a decrease of 29; and 596 Bachelors of Arts, or 57 fewer. Christ Church has 307 undergraduates; New College, 294; Balliol, 267; Keble, 216; and All Souls has fewest, with a total of six. There are 208 non-collegiate undergraduates. The following have upwards of 500 members on the books:—Christ Church, 1,388; Balliol, 1,005; New, 926; Exeter, 874; Keble, 747; Magdalen, 743; Trinity, 694; University, 662; St. John's, 653; Brasenose, 565; Merton, 534; and Queen's, 527.

COMMERCIAL SECTION.

POLYTECHNICS AT HOME AND ABROAD: THE TECHNIKUM AT WINTERTHUR.

TABLE OF SUBJECTS AND NUMBER OF LESSONS WEEKLY.

Sections	I. Building.					II. Mechanical Engineering.						III. Electrical Engineering.						IV. Instrument-Making.				V. Chemistry and Dyeing.						VI. Industrial Art.					VII. Surveying and Agricultural Engineering.						VIII. Commerce.						IX. Railway Service.			
Semesters	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.	5.	6.	1.	2.	3.	4.
German Language[1]	3	2	..	..	..	3	2	..	..	..	..	3	2	..	..	..	..	3	2	..	..	3	2	..	..	..	..	3	2	..	..	..	..	3	3	3	3	3	3	5	5	4	4
French Language	*3	*3	*3	*3	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	3	3	3	3	3	3	4	4	4	4	..	..	5	4	4	4
English Language	*3	*3	*3	*3	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	4	4	4	4	4	4	*3	*3	*3	*3
Italian Language	*3	*3	*3	*3	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	..	..	*3	*3	*3	*3	*3	*3	2	*3	..	..	*3	*3	*3	..	..	..	3	4	4	4	4	4	5	4	3	3	..	..	..	..	..	..
Spanish Language	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	*2	*2	*2	*2	..	..	..	..	..	..	..	..	..	..	..
Arithmetic	4	..	..	..	..	4	..	..	..	..	..	4	..	..	..	..	..	4	..	..	..	4	..	..	..	..	..	4	..	..	..	..	..	4	..	..	..	..	..	3	3	2	2	..	..	..	..	..	..
Commercial Arithmetic	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	4	4	4	..	..	..	..	..	..
Book-keeping	..	..	..	..	2	..	..	..	..	2	..	..	..	..	..	2	..	..	..	..	2	..	..	..	..	..	2	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..
Political Arithmetic	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..	..	..
Algebra	4	3	..	..	..	5	4	4	2	..	..	5	4	4	2	..	..	4	3	..	..	4	3	..	..	..	..	..	..	..	..	..	..	4	4	4	3	..	..	2	2	..	..	..	..	..	..	..	..
Analysis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..
Geometry	4	3	..	..	..	5	4	3	2	..	..	5	4	3	2	..	..	4	4	..	..	4	4	..	..	..	..	..	..	..	..	..	..	4	4	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Applied Geometry	..	..	2	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	6	4	3	..	..	..	..	..	..	..	..	..	..	..
Descriptive Geometry	..	4	..	..	..	..	6	4	..	..	..	..	6	4	..	..	..	..	4	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Applied Descriptive Geometry	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Analytical Geometry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Spherical Trigonometry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Mathematics	..	..	2	..	..	..	..	..	..	*2	..	..	..	..	..	4	2	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Applied Mathematics	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Land Surveying	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Professional Calculation	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mathematical and Physical Calculation	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
History of Commerce and Civilisation	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2	..	..	..	..	..	..	..	..
Geography	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..	2	2	2	2	..	..	3	3	2	2
Commercial Geography	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2	2	..	..	..	..	..
Determination of Longitude and Latitude	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
Agricultural Botany	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anatomy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Physics	3	3	..	..	..	2	5	4	..	..	..	2	5	4	..	..	..	3	3	..	..	3	3	4	2	2	..	..	..	..	..	..	..	3	3	3	..	..	..	3	3	..	..	..	..	..	3	4	..	..
Physical Laboratory	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Errors of Observation and Method of Least Squares	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Mechanics	..	..	..	..	..	..	..	5	7	..	..	..	..	4	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Technical Mechanics	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Architectural Mechanics	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Hydraulics	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Microscopy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Elasticity	..	..	..	..	..	..	..	3	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Graphic Statics	..	..	..	..	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mineralogy and Petrology	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Geology	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Chemistry	3	3	..	..	..	3	3	..	..	..	..	3	3	2	2	..	..	3	3	..	..	..	..	..	..	..	..	3	3	..	..	..	..	3	3	..	..	..	..	3	3	..	..	..	..	..	..	..	..
Analytical Chemistry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Inorganic Chemistry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Agricultural Chemistry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Organic Chemistry	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Technical Chemistry	..	..	..	..	..	..	..	..	..	..	*2	..	..	..	..	..	..	..	..	..	..	..	..	3	3	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chemical Laboratory	..	..	..	..	..	..	..	..	..	..	..	..	..	4	8	..	..	..	..	..	..	..	10	18	16	16	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dyes	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Dyeing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	}4	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bleaching and Printing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Technology	..	..	..	..	..	..	..	..	2	..	..	..	..	..	2	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..	..	..
Mechanical Technology of Fibrins	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Technological Laboratory	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	3	..	..	..	..
Political Economy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..	2	2
Debating Course on Political Economy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..
Theory of Insurance	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..
Theory of Customs and Treaties of Commerce	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..
Post Tariffs	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	}2	..	..	..	..	..
Railway Tariffs	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	2
Commercial Law	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	..	..	..
Course of Law on Building	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Course of Law on Bills of Exchange	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..
Course of Law on Railways	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2
Registry of Land	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..
Calligraphy	1	..	..	..	..	*1	*1	..	..	..	..	*1	*1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	2	2	..	..	..	..	2	1	..	..
Stenography	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	1	..	..	..	..	3	1	..	..
Office Work	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	5	5	..	..	4	4
Freehand Drawing	5	..	..	..	..	4	..	..	..	..	..	4	..	..	..	..	..	4	..	..	..	4	..	..	..	..	..	20	14	14	10	14	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Geometrical Drawing	6	..	..	..	..	}7	..	..	..	..	..	}7	..	..	..	..	..	}7	..	..	..	6	..	..	..	..	..	6	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rough Drafting	..	..	..	..	..	..	4	..	..	..	..	..	4	..	..	..	..	..	}12	..	..	..	}6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Machine Drawing	..	..	..	..	..	..	6	8	10	..	..	..	6	7	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Style in Industrial Art	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Ornaments	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ornamental Drawing	..	4	5	6	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Perspective Drawing	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Architectural Drawing	..	5	9	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	4	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Architectural Rough Drafting	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Professional Drawing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	15	18	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Plan Drawing	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	4	}6	}4	..	..	..	..	..	..	..	..	..	..	..
Cartography	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moulding	4	..	4	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6	6	5	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Architectural Constructions	..	5	7	7	4	..	..	..	..	..	2	..	..	..	..	..	*2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	4	..	..	..	..	..	..	..	..	..	..	..
Theory of Building	..	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Constructive Forms and Ornaments	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Sections in Masonry	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Knowledge of Building Materials	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..
Estimates of Building Costs	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Functions of a Builder's Overseer	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Architectural Style	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Systems of Heating and Ventilation	..	..	..	..	2	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Supply of Water and Light	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	}4	..	..	..	..	..	..	..	..	..	..
Systems of Drainage	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Joining and Settling of Fields	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..
Theory of Construction of Roads and Earthworks	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..
Theory of Machinery	..	..	..	..	..	..	..	..	..	5	4	..	..	..	..	6	4	..	..	..	..	..	..	..	4	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Mechanical Constructions	..	..	..	..	..	..	..	4	5	5	5	..	..	3	4	4	..	..	..	}14	}16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Practice in Mechanical Constructions	..	..	..	..	..	..	..	..	6	12	18	..	..	..	10	12	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Spinning	..	..	..	..	..	..	..	..	*3	*3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Weaving	..	..	..	..	..	..	..	..	..	..	*2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hydraulic Building	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..
Electrotechnics	..	..	..	..	..	..	..	..	..	3	3	..	..	..	2	5	5	..	..	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Electrotechnical Laboratory	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Calculations and Estimates of Machine-Making	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Machine Tools	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Theory of Scientific Instruments	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Course on the Construction of a Railway	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..
Railway Station Service and Service on the Lines	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5
Forwarding Service	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2
Telegraph Service	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..
Signalling	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2
Railway Management	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	1
Course for rendering Assistance in Case of Accidents	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..
Gymnastics	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
Repetition Course	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Weekly Total (compulsory subjects only)	37	34	39	39	41	33	34	35	35	34	34	33	34	39	38	39	37	32	36	37	36	34	38	37	38	36	38	39	40	45	42	44	37	35	36	34	34	32	34	34	31	32	32	31	31	35	36	35

[1] A special German class for foreign pupils is held.

* Optional.

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895–96.

Teachers' Tenure of Office: Important Statement by Sir John Gorst. In the House of Commons, on Friday afternoon, December 7, Sir John Gorst, in reply to a question, said the Government hoped to be able to deal during 1901 with the question of teachers' tenure of office in primary schools—an announcement which gave considerable pleasure to the members of the N.U.T. Executive at the meeting held on the following day. Sir John is evidently bent on fulfilling the pledges he has given on more than one occasion; he clearly recognises that, with superannuation an accomplished fact, something must be done in the direction of reasonable security of tenure. Bravo, Sir John!

The 1901 Conference. It may appear strange to give, at the present moment, particulars of the work of preparation for the next Conference; but, after all, it is not such a far cry to Easter 1901!

Our Great Yarmouth friends, having secured the honour of selection, set to work at once upon the necessary arrangements, looking into every detail, and leaving nothing to chance. The local teachers recognised the fact that theirs was the smallest association that had undertaken to provide Conference with its annual home; they were not, however, dismayed, and assisted by a loyal contingent of workers from Lowestoft and Norwich, they threw themselves heartily into the business, determined that if failure should result the fault should not be theirs.

The Great Yarmouth Scheme. It was, of course, understood from the first that when the east coast town invited the York representatives to pin their faith to East Anglia, no responsibility for raising a record sum for the Benevolent and Orphan Fund would be accepted. Those who have had to make the arrangements entirely disagree with such a principle, which, in their opinion, means the shuffling out of the responsibility of maintaining this fund by those on whom it has the strongest of claims—namely, every individual member and association of the Union. A circular has been drawn up, therefore, embodying those views, and calling upon every association to undertake to do its duty in this respect. And the plan suggested is simplicity itself, being within the powers of even the poorest paid teacher in the country. The scheme is simply this: Let every association raise at least 5s. per member. This can be done by means of the staff card scheme, concerts, bazaars, magic-lantern entertainments, etc., etc.

It is absurd for *any teacher* to say he or she cannot raise 5s. in one of the ways suggested, and it is still more absurd for any association to say it cannot guarantee 5s. per head of membership. The thing *can* be done, and *must* be done, for £10,000 a year is really not sufficient to meet the requirements to-day.

The Local Effort. It is understood that the greater number of the local associations have sent no reply to the Yarmouth circular, but our friends there need not trouble. The replies will come, and, what is better still, the money will come from the vast majority. In the meantime, Conference town workers are doing all they can in the way of weekly concerts at the Town Hall, school sports and entertainments, a children's flower show of hyacinths, smoking-concerts, soirées, balls, and other attractions. The ladies are naturally in evidence; there is to be a two days' bazaar under their care, in the Town Hall, with all the local celebrities as patrons, headed by the member of Parliament for the town. Will readers of this journal kindly remember that donations of goods or cash will be thankfully received by the Conference Secretary at any time before the date of opening, January 30, 1901? One other note may be of interest. The Publishers' Exhibition will be held in the same building as the Conference—an arrangement which exhibitors, to say nothing of representatives, will appreciate. And there will be the further advantage of a refreshment bar and dining-rooms in the same building.

Extension of N.U.T. Premises. Many who remember the old N.U.T. premises in Fleet Street, and who have seen the present offices in Russell Square, can scarcely, perhaps, realise that additional accommodation is now absolutely necessary. The rapid growth of every department—law, tenure, finance, organisation, parliamentary, education—the equally rapid growth of every branch of the Orphan and Benevolent and the Provident work, and the extra storage required in consequence of all this extension of effort, made a larger building not only desirable but essential. Fortunately, the offices will not be moved to another part of London, for those charged with the arrangements were able to secure the adjoining house. With the New Year, the two buildings will be, to all intents and purposes, one, and it is to be hoped that every branch of the Union's work will now be adequately housed. The expense will perhaps be great, but the expenditure could not be avoided; and when members have seen the Russell Square building, and all the accommodation which it provides, they will not be slow to say the Executive has done wisely in incurring the additional responsibility which the increased rent involves.

The Tenure Meetings. Very successful tenure meetings continue to be held in various parts of the country. Now and then the attendance of the local teachers is not what it should be. Why is it? It is suggested that in certain centres there is no difficulty in the matter of tenure of office, and that therefore it is not incumbent upon teachers to make any effort to be present. This is not true unionism, for the meetings are being held, not so much to attack an evil in a particular centre, as to enlighten the general public in all parts of England and Wales upon a matter which calls for immediate attention. Teachers, therefore, are in duty bound to attend, if only as a recognition of the labours of the Executive in the direction of securing reasonable security of tenure. Reference was made in our last issue to the splendid meeting at Bishop's Stortford, when the great hall was completely filled, and when among the audience were Sir Walter Gilbey, the Diocesan Inspector of Schools, and many other clergymen. Since that meeting another East Anglian "demonstration" has been held in the city of Norwich, when the "presiding officer" was the chairman of the city School Board. In the matter of attendance of teachers there was room for improvement, but the proceedings were exceedingly interesting, and the Union's resolutions were carried unanimously.

One of the interesting features of the gathering was the presence upon the platform of Mr. Thwaites, who some time ago was dismissed unjustly by the Brinton School Board. It was a case in which the N.U.T. very properly interfered: its victory—for it was undoubtedly a National Union victory—was hailed with delight all over the country. At the School Board election a majority was returned in favour of reinstating the teacher, and at the first meeting of the new Board the resolution to re-appoint him was carried. Over and over again it has been proved that when once the general public understands the position, justice is done to the teacher, and this was the case at Brinton.

Class Teachers' Resolutions at the Yarmouth Conference. If fortunate in the ballot for a good place on the next Conference Agenda, class teachers' grievances will be brought prominently before the public at Easter. Every one admits that great reforms are necessary, and it is to be hoped, therefore, opportunity for full discussion will be found. The resolutions already adopted deal with the salaries of assistant-teachers, additional certificates, discipline in schools, training of teachers, the certificate list, confidential reports and log book entries, large schools and large classes.

Exhibition of Modern Illustration.—The Board of Education has decided to open this exhibition on Monday, seventh January next, in the galleries of the Indian section of the Victoria and Albert Museum, South Kensington. A private view will be held on Saturday, fifth January.

NOTES FROM THE NORTH.

Report on Educational Exhibits at Paris. Mr. John G. Thomson, ex-president of the Institute, was deputed by the E.I.S. to visit the Paris Exhibition and give a report of the educational exhibits there. This he has done, and in a most interesting report he has given us his impressions. It would not be possible in the space at our disposal to give even a synopsis of that very detailed and admirably written work, but we would like in a few sentences to refer to one or two of the conclusions he has reached.

His first thought is that France has done well to make *enseignement* the foremost of all the *groupes*, not only as being the root of all others, but as being the first thought and desire in the mind and heart of the present day. In all countries he thinks the outcry is "Education"—more extended, more perfect education; education of hand and head and heart; education deeper, higher, broader, fuller: for education is the mainspring of progress.

His second thought is that we cannot, we dare not, stand still in this great contest. Stagnation is destruction. We must hold the van in education if we wish and mean to be the foremost in the *race* of races. Progress in might and dominion is cognate with progress in art and science. Manufactures and commerce increase as knowledge and training increase. Army and navy lean upon intelligence.

He then refers to the work of our schools in kindergarten and manual training, in which he thinks we can stand comparison with other countries; and to the technical exhibits, which if far down in quantity, are no whit behind in quality. In the section devoted to the question of physique he is of opinion that Britain is surpassingly rich. In the education of women Scotland takes a high place, as she also does in the provision for the training of defectives.

His remarks, however, with regard to the radical evil with which teachers have to contend in the case of Scotland—namely, the too early withdrawal of children from school—are well worth attention. So long, he says, as there is at the Fifth or Sixth Standard an exodus, a hegira, so long shall we be likely to fall behind other lands, especially Germany, in the march of amelioration. England is allowed the Seventh Standard as exemption bourne; why should Scotland be denied the privilege?

His closing references to education and to the teacher are worth being quoted in full. Of education he says, nothing is borne in upon the mind more surely from a survey of the treasures of *enseignement* throughout the Exposition than "the formation of a national conscience over all civilised lands" in reference to education. Money is spent unstintedly on schools, and is recognised not as national expenditure, but rather as a national investment. Even in our own land, where the State is apt to relegate much public reformatory work to private philanthropy, the purse-strings of the exchequer are opened to no call more readily than to those of the soldier, the sailor, and the educationist; and these may well be classed together, for they constitute the triple line of our national defence. Army and navy keep off the foe, and form our natural national fence; school wards off decay, and secures the future—it is our mental and moral fence.

With reference to the educator, he says it must be remembered that not Dover House nor the School Board, but the schoolmaster, is the supreme factor in education. Whatever advances the man, improves the work. Whichever nation secures the best class of men and women in mind and heart for the office, will have the best schools, and all that accompanies or flows from such a blessing. Therefore every attention should be given to make his position comfortable and secure; and, seeing he is debarred all fortune-making, his old age should be delivered, in proper measure, from paralysing fears. Then the nation will have the best results in that most important part of its economies, which deals with the renewal of the world, and therefore its progress.

The report, as will be seen from these excerpts, is a most instructive and suggestive one, and our only regret is that it will not have a wider audience. It has been incorporated as an appendix to the year-book of the Institute, but it is deserving of the attention of many who will not receive that volume. We should have liked to see it in pamphlet form and disseminated broadcast among School Boards and managers, and we feel certain that many teachers across the Border would have been delighted with its contents.

The Leaving Certificate. Circular 300, just received, deals with the Leaving Certificate. The Scotch Education Department is of opinion that every school that is well equipped and well organised for the purposes of higher education, ought to aim at the Higher Certificate for all pupils of its upper classes, and that it ought not to find the standard too high for a considerable proportion of them.

They regret that candidates are too frequently sent in for the Lower-Grade Certificate at too early an age. The bad effect of this is twofold, inasmuch as it entails failures and disappointments, and causes a certain number of ordinary pupils to attempt the Higher-Grade paper before they have reached the normal close of the school curriculum.

With regard to the Honours Grade, it points out that there are signs of serious misapprehension. It is assumed that a pupil who has passed the Higher Grade is able, after an additional year of study, to pass the Honours. Pupils of no more than ordinary ability are thus encouraged to try what is beyond them, and their failure is apt to be misunderstood. Honours Certificates are meant to be a recognition of exceptional aptitude and ability in individual pupils.

Taken all over, the Department believes that the results of the Leaving Certificate Examination in any school furnish a very valuable test of general efficiency. But regard should be had to all the attendant circumstances. Unless the conditions are similar, mere numerical comparisons between one school and another may be quite misleading. The Department, however, deprecates any tendency to gauge the quality of the teaching of a school simply by the number of Honours Certificates gained by its pupils.

What of the Profession? We have had occasion during the last few months to refer in these Notes to the question of the better status of the profession, and we would at least expect the professors of education in our universities to give us some assistance in the matter. But what do we find? Dr. S. S. Laurie, Professor of Education in the Edinburgh University, in his evidence before the Commission on Commercial Education, referred to in last month's issue of The Practical Teacher, compares the career of a clerk with that of a teacher. Speaking of the teacher's career, he says: "*Even* a teacher who has never been at a university, but has had only two years at a training college, at once enters on a profession with £80 or £90 a year, and *an absolute certainty of promotion, if he be worth his salt.* He has also a certain status, about twelve weeks' holiday a year, besides his Saturdays, and finally the prospect of a pension. This is the prospect of the average teacher. What prospect has the average clerk in commerce?" (The italics are ours.) If he means by this statement to compare the work—the mechanical work—done by a clerk with that done by a teacher, it is most derogatory to the office and work of the teacher, and is hardly such a statement as one would expect from a professor of education. Surely the training demanded for a teacher is a little more than that required for a clerk. If he refers more particularly to the emoluments of the profession, we need not say that his opinion is opposed to that of the majority of his profession. Why he should say *even* a teacher, we cannot imagine. Then again, does Professor Laurie know, as we are led to understand is the case, that in Edinburgh, where he teaches, promotions take place at the rate of one a year? this present year there have been none. How, then, can he say there is an absolute certainty of promotion? Are the teachers who are now entering the Edinburgh School Board, or who have for years been in their service, not worth their salt? Is he aware that there are some thirty class teachers who have reached their maximum under that Board? Are they sure of promotion at the rate we have just mentioned? Yet we believe many of them are capable and efficient teachers. We think Professor Laurie might have given the matter greater consideration before publicly making such a statement.

BLACKBOARD DRAWING.

COPYING ILLUSTRATIONS.

BY EDITH E. BAMFORD, ART TEACHER, EDGE HILL TRAINING COLLEGE.

VIII.

IT is obvious that it is impossible for a teacher to produce the actual objects as illustrations for every lesson, though such would of course be the best illustrations. Again, it is absurd to expect a teacher to sketch all such objects from memory; for not only may they be unattainable as models, but the drawing might demand such skill as even a well-trained draughtsman does not possess. But generally a teacher may have, or may be able to procure, a good printed illustration on which a skilled artist has spent considerable time. This, if sufficiently large for the class to see, can be exhibited; or, if small, the teacher can easily reproduce and enlarge it on the blackboard. It is astonishing with what ease and rapidity a reproduction can be made after a little practice. The sketches need not be made from memory, as the committal to memory might mean a considerable expenditure of time on the teacher's part which would produce no corresponding gain for the pupils.

A teacher should train himself to copy illustrations, for practice is required to give dexterity, and to enable him to discover the different ways in which the parts can be effectively reproduced. After such training, he should be able to sketch quickly and effectively a bold reproduction of the essential parts of an illustration. No blackboard sketch need take longer than ten or fifteen minutes, but in order to sketch so quickly the drawing must be direct, so that no time is wasted in discovering methods of work. As a rule, the details should be omitted, and only the essential parts reproduced, or the effect will be confused. The usual method of shading is reversed, as instead of putting a dark tone on a light background, the light tones are put on a dark background. The chalk worked on the blackboard heavily gives the high lights, whilst the chalk worked on the board and then rubbed in with the fingers gives the middle tone, which will be found to be a very useful tone; the board itself gives the dark tone. An artistic production cannot be made successfully on a blackboard, as the surface of the board and the chalk are not good media for shading, though a bold, striking sketch, which will serve well as an illustration for a lesson, can be made. It is not always advisable or possible to work these sketches before the class; but when such is the case, considerable interest will be roused in the pupils during their development. If the subject is difficult, it is best to prepare the sketch before the lesson.

THE BELL ROCK LIGHTHOUSE.

The general rules for copying an illustration on the blackboard are:—

1. Make a faint general outline of the chief features of the illustration, with a few straight lines, thus indicating position rather than form.

2. Rub the chalk lengthwise on that part of the blackboard where the highest lights occur, and then gradate where necessary with the fingers. Remember that a soft gradation from a high light will give a rounded effect.

3. Harden the outline where it is required for clearness, and give the necessary curves to the lines.

It is quite essential for speed and accuracy that the chief objects be put in position first

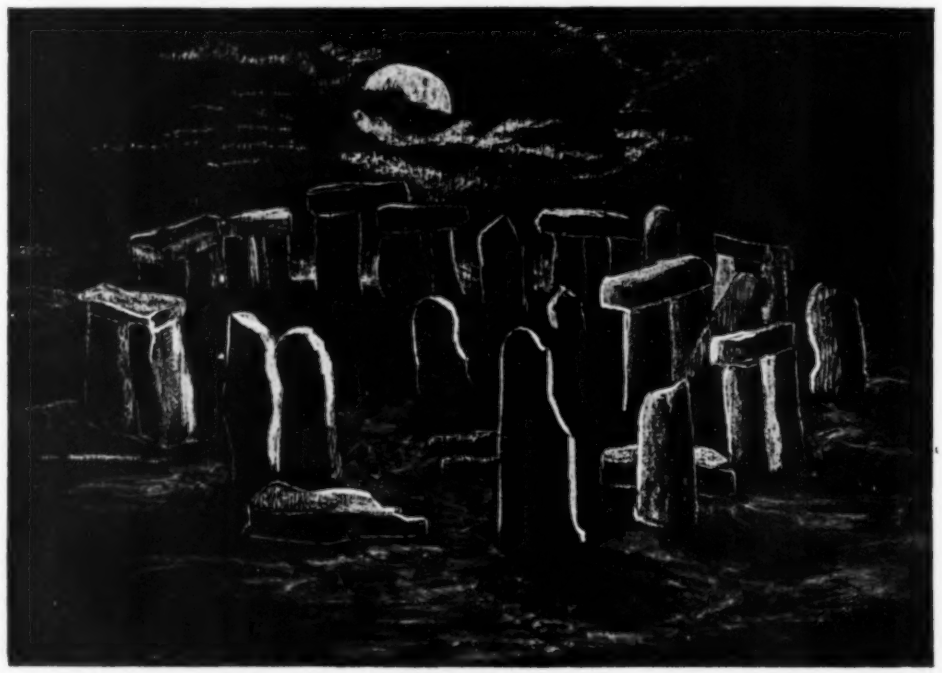
NORSE GALLEY.

PRINCE OF WALES'S FEATHERS.

the feathers. Soft gradations are needed to give the rounded effect. Where there is a strong light, outlines to be shown through it will have to be sketched very heavily, as on the front of the crown.

The Lighthouse.—The middle tone is used here for the clouds and the rounding of the lighthouse. With a little practice it will be found where this tone can be effectively used. It will also be found that if the rough surface obtained by merely rubbing the chalk on the blackboard be used alone, the sketches will not stand out clearly in most cases. For the foam the chalk should be rubbed on thickly.

Stonehenge.—This is a more ambitious subject, but it is not difficult. Two circles should first be lightly drawn to indicate the top and bottom of the stones, which should next be faintly sketched in place. The hard, light tones of the stones and clouds should be next worked, and then the smooth shading of the ground. The shadows of the stones



STONEHENGE.

with a few faint straight lines, for this obviates alterations in the later stages. It is only in the last stage that attention need be given to the quality and curve of the line. If an outline sketch only is wanted, Rules 1 and 3 should be followed.

The teacher will find that illustrations of the kind here described are very useful, particularly in teaching history, when, for example, the dress and houses of certain periods can be shown; in giving lessons on geographical terms, as a bay, island, or volcano; and also in nature lessons.

A few typical examples have been taken from Nelson's Royal Readers in order to show the method of work; but if the class have reading books which contain the illustration required, it is time wasted to reproduce it, for the print, though small, will be sufficiently large for the individuals. In the examples here represented the illustration in the reading book is shown, and a photographic reproduction of the blackboard sketch made from the illustration.

A Norse Galley.—This is almost an outline sketch. A little shading is introduced, to give the curve of the sail and the hull of the galley. The gradations should be noticed here, and also the rough shading to indicate the water.

The Prince of Wales's Feathers.—Note that the highest light falls on the centre of the crown and the curved tips of

can be indicated by rubbing off some of the ground shading with the duster.

The chalk drawings here reproduced are only rough sketches. The drawing is not correct, as it has been worked quickly, for the time necessary to be spent in obtaining absolute accuracy would have been wasted. Unfortunately, the middle tone, which is gradated with the fingers, does not photograph clearly, and so does not come out well in the illustrations. The shading to give the curve of the waves, in the sketch of the lighthouse, for instance, should be stronger, as well as the shading on the curved tips of the feathers, which should also be carefully gradated to give roundness. The shading on the ground of Stonehenge should be more even, in order to show the shadows more clearly. The effect is seen best in the gradations on the sail and hull of the Norse galley. The value of the tone can be easily tested, however, by trying it on the blackboard; and its power of steadying and binding together the other tones can also be proved. All the softer tones can be best represented by it—such as faint cloud effects, ground gradations, or gradations to give roundness of form.

I propose next to give some hints on copying animals from illustrations, for it is not always possible to have the actual animal as a model for the lesson or for the sketch.

THE NEW CODE, 1900.

SUGGESTED SCHEMES OF OBJECT LESSONS.

BY W. DONE, B.A., HEAD-MASTER, BRIGHTON PUPIL TEACHERS' SCHOOL.

II.

A SMALL COUNTRY SCHOOL.

IN the November issue I suggested a list of lessons suitable for a large school in a seaside town. I propose this month to take the case of a small country school. I think this will appeal to a large number of readers of THE PRACTICAL TEACHER, as I so frequently find the lesson diagrams of that journal on schoolroom walls in country districts. I have talked with several rural teachers, and, I think, have fairly grasped the difficulties of the situation with respect to the requirements of the New Code. There is no doubt that, by means of object lessons, manual instruction, lessons in design, and other ways, we in England have of late years been really drawing out the faculties of the children, so that at the present day our system of primary education compares very favourably with that of other countries.

countries—in France after the disastrous war with Germany, and in England with Mr. Foster's Act of 1870.

Our great endeavour, therefore, should be to make the education in the village school more and more in harmony with the environment of the country child.

An ideal scheme, perhaps, would be that which is being carried out in the British Schools at Boscombe, Bournemouth. Here the boys have plots of land on which they follow out their lessons practically. At stated times, also, they receive practical instruction in the management of fruit trees, the growing of crops, and the improvement of the land by means of artificial manures, etc.

Such a course of instruction meets with the approval of the parents, for they find that not only are the children benefited mentally and physically, but that, by practising in their gardens at home, they lose the habit of wasting their time wandering about the streets in their leisure hours.

The first drawback to such a scheme as this is its expense. At Boscombe the cost has been mainly borne by Mr. T. G. Rooper, H.M. Inspector of Schools for Southampton, and, of course, the work can only continue as long as that gentleman subsidises it. The second objection is the impracticability of a teacher leaving the school in order to take a section of the children in such practical work, especially when, as is frequently the case, the whole staff consists of a master and

SCHEME FOR SMALL COUNTRY SCHOOL WITH AVERAGE ATTENDANCE OF FROM 20 TO 60 OLDER CHILDREN.

Staff (exclusive of Staff for Infants).—One or two Teachers, according to the number of Children.

	LOWER DIVISION.	UPPER DIVISION.
English	Reading from suitable reading books (to be changed from year to year). Copybook writing and transcription. Formation of easy sentences both orally and on paper.	Reading from suitable reading books (to be changed from year to year), one of which should be a History of England, and another a Geography book. Reproduction of passages read by children, letter-writing, written descriptions of simple objects discussed in object lessons.
	Suitable Recitation in each Division.	
Arithmetic	Group (*a*) as in Schedule I. for Standard I. Group (*b*) as in Schedule I. for Standard II. Group (*c*) as in Schedule I. for Standard III.	(*a*) as in Schedule I. for Standard IV. (*b*) as in Schedule I. for Standard V. (*c*) as in Schedule I. for Standard VI.
Geography	Simple lessons on Geography of neighbourhood, and outlines of England. Explanation of Geographical terms as they occur.	Study of contents of Geographical Reader, with oral exposition. Easy Map drawing.
History		Study of contents of Historical Reader, with oral exposition.
Common Things **Elementary Science**	A course of lessons, to be given to the whole school, dealing with objects familiar to the children, and with matters likely to bear upon the children's lives. Where there are two teachers, simple practical instruction in Horticulture or Domestic Economy may be added.	
Singing **Drawing and Needlework** **Physical Exercises**	As under former Codes.	

In an article in *The School Board Chronicle* for September 15, entitled, "Education at the Paris Exhibition," the writer gives it as his opinion that in French education the book is everything; self-education is nothing. "Each child is a reflection of his teacher, each teacher a similar reflection of his *professeur* at the Normal College, until children are turned out of school as beads are turned out from a bead-making machine." I recollect some years ago visiting an *école communale*, and was told that the Minister for Education could say at any hour of the school day what lesson any child was having in such a school. As the writer quoted before says, "It is here that the French sorely need to copy our more individualistic educational methods, for it is here that the 'superiority of the Anglo-Saxon,' as affirmed by one of their most philosophical inquirers, very largely consists."

It is the more interesting to compare the results achieved in France and England when one considers that compulsory state education started practically at the same time in both

a pupil teacher. But if the master cannot take the children out of doors for school walks, and give lessons on the spot about the birds, the insects, the flowers, and other objects of interest, much may be done in the schoolroom, by means of a selection of suitable examples, to quicken the intelligence and to foster a love for the country and for country pursuits.

As subjects, therefore, suitable for object lessons in elementary science I would suggest the following:—

CIRCULAR 369, COURSE V. (*b*, *c*).

Spring-time.—The waking of nature; the lengthening daylight in the morning and evening; the coming warm weather; birds singing, building their nests, laying their eggs; the trees and hedges changing; buds and leaves; the bloom on fruit trees.

The local wild-flowers of spring.—The daisy, primrose, bluebell.

Summer-time.

The local wild-flowers of summer.

Autumn.

The local wild-flowers of autumn.
Winter.—The repose of nature.
The land.—Woodland, meadow-land, ploughland, moorland.
The sky.
A bird.—Covering, wings, beak, feet, motion, nests, eggs, food.
Local birds.—Thrush or blackbird, lark, robin, rooks.
Birds which come for the summer.
Birds which come for the winter.
Local wild animals.—Rabbit, hare, fox, hedgehog.
The cottage garden.
The stream or river.—Its banks; the birds and animals that live near it.
The weather and wind.
The soil.—Sunshine, air, rain, frost, manure.
The farmer's tools.—The plough, drill, reaping-machine.
The crops.—Grass, corn, root-crops.
Wheat.
The potato.
The elm tree.
The apple tree.
An insect.
The butterfly.—Colours, beauty, life-history.
Bees.
The farmer's pests.
The farmer's friends.

PRACTICAL ELEMENTARY SCIENCE.

AN EXPERIMENTAL COURSE COVERING THE REQUIREMENTS OF BOTH THE DAY AND EVENING SCHOOL CODES IN PHYSICS AND CHEMISTRY.*

BY THOMAS CARTWRIGHT, B.A., B.SC.,

Author of "Practical Chemistry," "'Section One' Physiography," etc.

Experiments with Air.—The pupils have been led to learn from their experiments in burning a candle, phosphorus, and iron in air, that when bodies burn in air a portion thereof, equal in volume to one-fifth of the total amount, apparently disappears; and that the bodies in question—and from this it may be inferred that bodies in general—cannot burn in the residual four-fifths. To make sure that this latter statement is actually true, the bottle with the bottom removed should be again placed over some burning phosphorus and a burning candle in succession, and after the burning has ceased, the cork should be quickly withdrawn, and a lighted taper passing through a disc of cardboard should be plunged in the residual gas, matters being so arranged that the disc fits tightly over the mouth of the bottle, for which purpose the disc may be greased. The taper is immediately extinguished, a fact that corroborates our previous inference as to the one-fifth of the air that apparently disappears, and the four-fifths remaining behind in our previous experiments. Hence we may proceed to elicit that air consists of an **active** and of an **inactive** part, the two parts being in the proportion of 1 : 4. This is perhaps the most important fact to be educed in the study of air, and care should be taken to make the eduction thorough and convincing, for which purpose the candle and phosphorus experiments should be repeated again and again, until the student has no room in his mind for doubt; moreover, there should be no hurry to *tell* the pupil, as this is one of the things that should be evident to the worker from his work, so that telling should be regarded as inartistic, as it is certainly unnecessary. At the most a few leading questions only should be indulged in.

The Disappearing Fifth.—It will now be time to enter on a new quest—namely, does the fifth that disappears go out of existence or not? or, to put the matter generally, is matter destructible or not? The candle should be fixed to a well-perforated cork that fits the bottom of a lamp-glass, and a shelf of iron gauze should be fitted into the mouth of the glass, upon which should be placed some lumps of caustic soda, the whole being fixed to the arm of a balance and counterpoised; after which the candle should be taken out, without detaching it from the cork, and after having been lit, should be replaced, the pupils being required to note in their books what happens, and, if possible, to supply an explanation. Here, again, there should be little need of telling, its place being taken by judicious questioning as to the reason for the various steps taken—for example: Why is a balance employed? Why do we use a perforated cork? What is the caustic soda for, and why is it placed upon a *perforated* shelf?

The Case of Phosphorus.—A piece of hard glass tubing (combustion tubing) of about $\frac{3}{4}$-in. bore and about 6 in. long should be drawn out at one end to about $\frac{3}{8}$-in. bore. The narrow end should be lightly plugged with glass wool or with asbestos fibres. The wide end should be fitted with a cork carrying a piece of glass tubing of about $\frac{1}{4}$-in. bore, to which should be fitted by means of indiarubber tubing an L-shaped piece of glass tubing just long enough to pass through the cork of a narrow bottle or a test-tube, in the mouth of which the cork fits. This cork shou!d carry a longer piece of glass tubing, also L-shaped, one end of which passes through the cork, nearly to the bottom of the concentrated sulphuric acid with which the bottle or test-tube—whichever is employed—is to be three parts filled. The narrow end of the combustion tubing is also to be fitted with rubber tubing, to which is fixed another L-shaped piece of glass tubing passing through a cork fitted in the mouth of a large bottle—one of the acid bottles known as Winchester quarts will do very well indeed. This cork is also two-holed, the second hole carrying a long L-shaped piece of glass tubing that passes nearly to the bottom of the Winchester quart. A piece of phosphorus weighing about a quarter of a gram is placed in the combustion tubing, and the tubing with its contained phosphorus and glass wool, having been detached from its rubber connections with the test-tube and the Winchester quart respectively, is carefully counterpoised or weighed. The Winchester quart bottle is filled with water, and a third piece of rubber tubing is fixed to the long L-piece, and carries at the end remote from the glass L-piece a spring clip with which the rubber tubing may be closed, the free end of the rubber tubing being fitted with a straight piece of glass tubing. Whilst the rubber tubing is yet open, water is sucked up from the bottle through the straight tube, and a steady flow is brought about by the syphon thus extemporised. The rubber tubing is now closed by the clip, and the weighed tube is again fitted to the test-tube and bottle as before, after which the clip is removed and the flow of water is resumed. Next a bunsen burner or the flame of a spirit lamp is applied to the combustion tubing until the phosphorus is ignited, when the flame is removed, and the phosphorus is left to burn itself out. A residue consisting of red phosphorus will be left in the combustion tubing. This may either be neglected or be burnt at the choice of the teacher. As it requires a much higher temperature to burn it than is required to burn ordinary yellow or waxy phosphorus, it will perhaps be best to ignore the residue, especially as the combustion tubing may break if the heating is not carefully conducted. After the combustion tubing has been allowed to cool down, it should be again detached for a second weighing. If there is no gain in weight, the phosphorous oxide, instead of being caught in the glass wool or asbestos fibres, must have escaped, and the experiment should be repeated, more glass wool being placed in the combustion tubing, and a slower current of air being drawn over by regulating the syphoning over of the water from the Winchester quart bottle; but with ordinary care there should be a very sensible increase in the weight of the combustion tubing, and it is upon this increase in weight that the minds of the pupils must be concentrated. They may be told that the object of having the Winchester quart with its syphon is to draw over, or aspirate, as it is called, a current of air. In this connection they should be asked two questions: (1) How may we tell *how much* air has been used? and (2) what is the nature of the part of air that passes over into the Winchester quart bottle? They should be told that the sulphuric acid is used to dry the air, and here again should be noticed the device employed for making the air pass through the sulphuric acid.

The Case of Magnesium.—Having brought home to the minds of the pupils the fact that there is no destruction of

* Books referred to in this series of articles are published by T. Nelson and Sons.

matter in the burning of the candle and of phosphorus, the pupils may hark back to the burning of magnesium as affording further corroboration of this very important fact of the indestructibility of matter. It will be advisable to perform the experiment again, and for the pupils to record the three results side by side in their laboratory books, and to clearly state in their own language what they infer therefrom, and why this inference is a just one. Here, again, the teacher should guard against being in a hurry. Two or three lessons may be profitably spent in thoroughly mastering the facts and inferences that are to be got from the proper study of these three very important experiments.

It will be easy, now that the fact has been established that burning is not destruction of matter, to get the class to state that the apparent disappearance of the active part of air when burning takes place is simply change of form, and the further fact that the products of the burning are gases will not present much difficulty in arriving at it. What are these bodies? Are they simply the wax of the candle converted into gas, or are they new bodies resulting from chemical combination? This is the question to be answered by the next series of questions.

What bodies are formed when gas, oil, and candles burn?—Take a perfectly dry tumbler, and place it over a piece of candle that is burning until the candle goes out. Closely observe the sides of the tumbler. What may be suggested by their dimmed appearance? Again attach a piece of candle to some copper or iron wire, so that it may be held, whilst yet burning, in a gas jar or bottle. Light the candle, lower it into the gas jar, and let it burn for some minutes. Then pour some clear lime-water into the jar, and after removing the candle shake up the lime-water. There is evidently something present in the jar that was not there before the candle was made to burn in it, and this something possesses the power of turning lime-water milky. Repeat these two experiments, substituting the flame of a lamp and that of a gas-burner (turned low) for the candle flame, and compare the results obtained in the three cases. In order to ascertain what it is that causes the dimness on the sides of the tumbler, perform the following experiment:—Hold a glass retort upright, with the beak at the top, and the opening or tubulure at the bottom. In this tubulure fit a piece of glass, or better still, brass tubing, that is wide enough at the bottom to permit a small gas flame to burn in it. Keep the bulb of the retort cool by placing a piece of blotting-paper, which is from time to time moistened with cold water, upon it. Light the gas flame, and let it burn until the bulb of the retort contains an appreciable amount of liquid. Or the experiment may be performed in this wise:—Connect a piece of glass tubing drawn out to a jet with the gas supply, and fix the jet so that the flame may impinge on the bottom of the bulb of a retort held horizontally—not vertically, as in the last experiment. Let a piece of rubber tubing be connected with the gas supply, and let the other end pass down the tubulure of the retort, in such wise as to send a continuous current of water through the retort, the beak of the latter being so arranged as to let the overflow of water fall into a sink or other suitable receptacle. Light the gas jet, and place a beaker or a tumbler under the bulb of the retort in such a position that the drops of liquid which soon begin to form may be caught as they fall. The object of the current of water that passes through the retort is, of course, to keep the bulb cool, and so to cool the gas that is formed by the burning of the flame as to liquefy it, instead of allowing it to pass, as it usually does, into the air as a gas. This should be explained to the class, as on all occasions it is advisable that no part of the operation that can be understood by the children should remain obscure. We have now established the important fact that a liquid is formed when a gas jet burns, and the same may be shown to be true when a candle or a lamp burns, as, indeed, has been suggested by the tumbler experiment. What is this liquid? The answer will inevitably come that it is water, and a good opportunity will present itself for driving home the maxim, absolutely essential to solid advance in science, *Prove all things*. How do we know that it is water? Bodies are known by their properties. What peculiar properties does water possess wherewith we may test our liquid? Many answers will be forthcoming, and at last the teacher may get the children to see that by boiling the liquid and by freezing it with a thermometer placed therein, we may see whether or not the liquid really is water. This should be done by the teacher, the freezing being accomplished by means of a mixture of ice and salt, or of hydrochloric acid and sodium sulphate. This having been accomplished, we may proceed to see what we have learned about burning. It has been shown that water and something that will turn lime-water milky have been formed when gas, oil, and candle burn. The teacher may please himself whether or not he tells the class that the something that acts so peculiarly upon lime-water is carbon dioxide. The point is immaterial. The thing is to know that these two bodies are really formed when burning of ordinary illuminants takes place; and next, to ask whether or not these are new bodies. Certainly gas, oil, and candle are not water, so that water is a new body formed in the act of burning. Also, if gas is passed through lime-water, and if candle and oil are placed therein, no milkiness will result; hence the body that turns lime-water milky is a new body also formed in the act of burning. What does this teach us about burning itself? Surely that it is chemical combination—a fact that must be driven home pertinaciously. The chief care will be to show the special characteristic of this form of chemical union, which is the production of great heat and light. This should be regarded as a proof of the energy of the combination that takes place in burning, the heat and light being simply manifestations of energy, and not, of course, material bodies. Reference should be made to less energetic examples of combination, than which no better instance can be furnished than the combustion of our own bodies. Call attention to the heat of the body. Let a boy breathe into lime-water, and ask if water is produced by our bodies, special notice being taken of perspiration in this connection. Emphasise the fact that exactly the same new bodies are produced by the burning of our bodies as by the burning of a candle, the only difference being that much less heat is produced in the former than in the latter case, and so lead up to the conclusion that **burning is energetic chemical combination**, the heat and light produced being the measure of the energy.

Now, as it has been shown that a candle in burning uses up the active part of air, and that water and the gas that turns lime-water milky result from this burning, the children should be able to see and to state that water and the gas that acts so peculiarly upon lime-water are the result of the joining together in the chemical way of the active part of air and some part of the candle; and as these two bodies are formed when gas, oil, candle, wood, and our own bodies burn, it should be evident that there are at least two substances—namely, that forming water with the active part of air, and that forming the gas that turns lime-water milky with the active part of air in gas, oil, candle, wood, and our bodies. We may at once show that soot or carbon can be got from all these substances by simply holding a flask filled with cold water over the three flames, and by burning a piece of meat; and a step further may be experimentally taken by powdering some charcoal and igniting it on an iron saucer or a deflagrating spoon, and by lowering it into a vessel into which we pour some clear lime-water after removing the carbon therefrom. The milkiness will show that it is from the union of carbon with the active part of air that the gas which turns lime-water milky is produced. Special corroboration of this will be afforded later when dealing with oxygen, so that there is no special need for dealing with this point at this stage if the teacher does not wish so to do.

The teacher may wish to study with the class the structure of flame. If so, now is the time to do this. The points to insist upon are the existence of the three zones. The inner, of no combustion, may be shown by putting a piece of glass tubing in the centre of the flame and igniting the gas that issues from the tube. The outer hot zone is easily shown by placing a piece of platinum wire in it, when it becomes white hot, and shows that where there appears to be no flame there is indeed the hottest part of the flame. In like manner, by placing a piece of paper in the flame and observing the scorching that corresponds to the outside of the

flame, the blackening that answers to the middle zone, and the absence of these two effects in the central area, the existence of the three zones may be established ; and referring to what has just been said, it will be evident that the outside of the flame, in juxtaposition with the wealth of air that surrounds it, will be the area of most combustion, just as the cold inner zone, from which air is practically absent, will be a zone of no combustion. But this is no part of our course, and can only be indulged in as a luxury from our present standpoint.

PERSPECTIVE METHODS.

BY HENRY WILKINSON, ART MASTER, SCIENCE SCHOOL, GATESHEAD.

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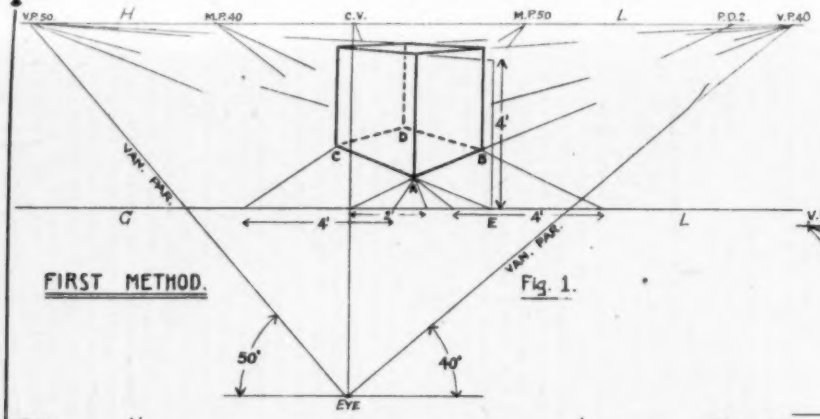

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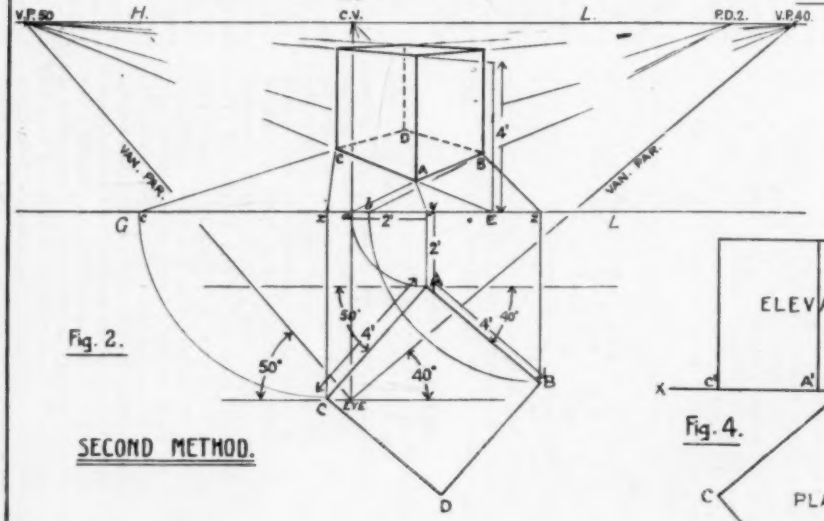


Fig. 2.

SECOND METHOD.

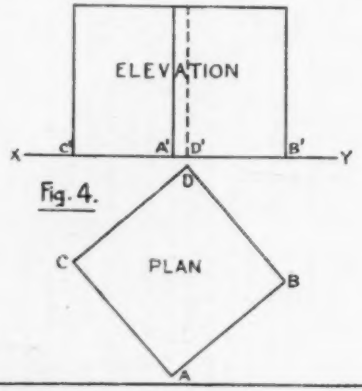
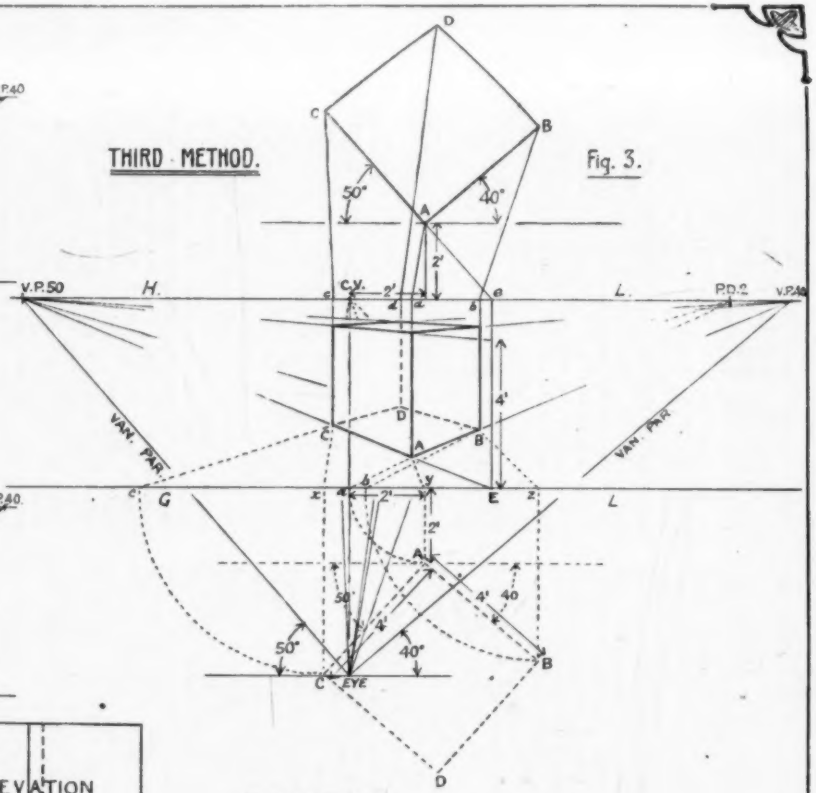


Fig. 4.

THIRD METHOD.

Fig. 3.



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H. WILKINSON. 1900.

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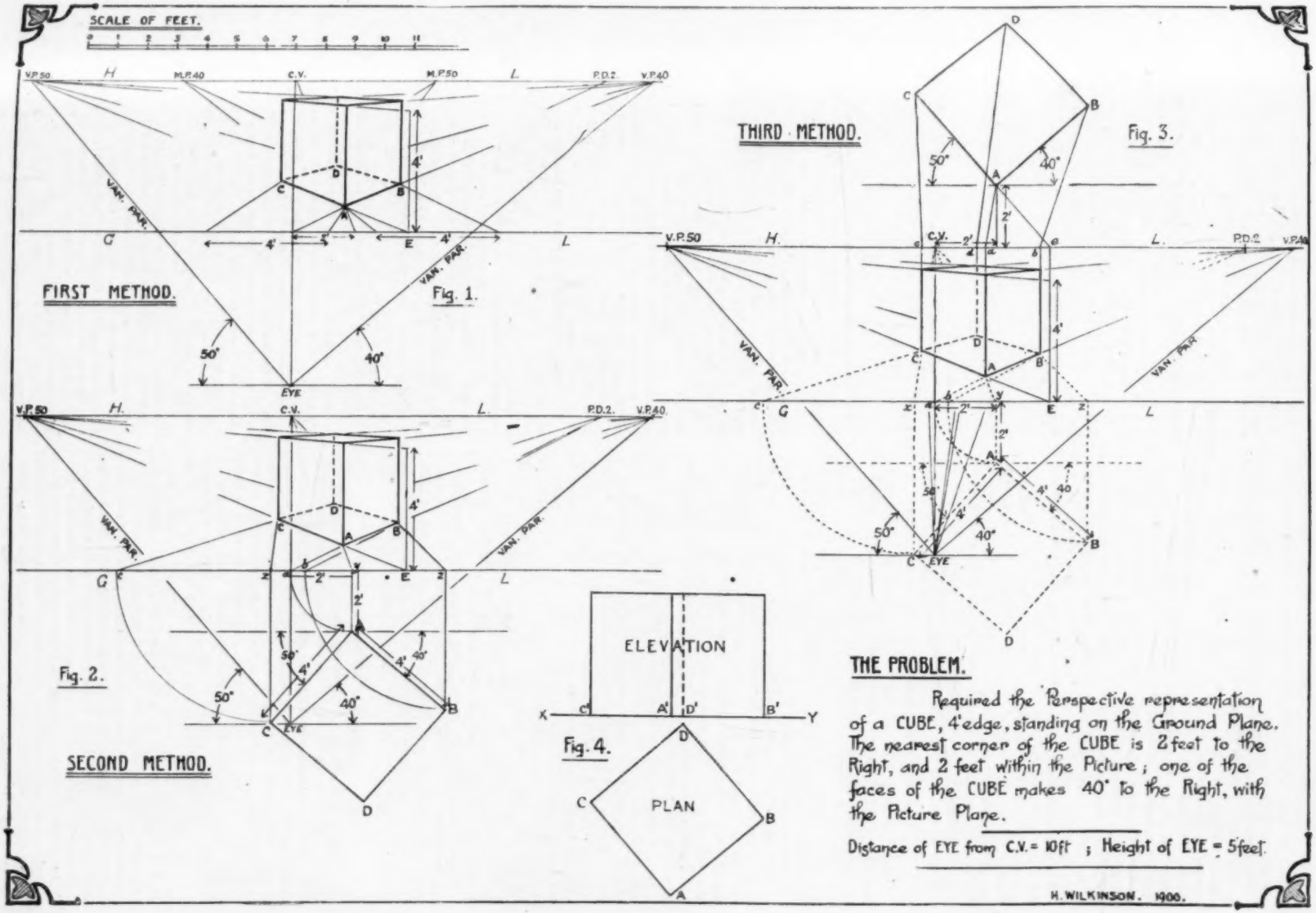
SCALE OF FEET.
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4'
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EYE
50°
40°
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riches. Almost the whole of the taxation falls upon the labouring classes.

The laws are based upon the precepts of the Koran, and must never oppose its doctrines. The "mollâhs," or priests, possess immense power, and in reality dictate the laws. Lord Curzon of Kedleston says that "Islamism is a system embracing every sphere, and duty, and act of life. Marvellously adapted alike to the climate, character, and occupations of those countries upon which it has laid its adamantine grip, Islam holds its votary in complete thrall from the cradle to the grave. To him it is not only religion; it is government, philosophy, and science as well. The Mohammedan conception is not so much that of a state church as, if the phrase may be permitted, of a church state."

The present Shah and his predecessor showed in many ways signs of enlightenment, and they evinced desires to introduce into the country many of the arts and manners of Western civilisation, but to these the priesthood always presented the most uncompromising opposition. Such, then, is the country in which Russia and Great Britain desire to possess paramount influence, and at the present time it is difficult to estimate the final outcome of the contest.

Russian Aims.

Persia presents features very similar to those of China in many respects. The country is rich, but weak; the officials are generally hopelessly corrupt; the resources of the country are indisputable, and the industry of the people is beyond question. There is abundant scope for railway enterprise, for, except a line of a dozen miles near the capital, railways are non-existent. The seat of government, too, is in the north, and therefore nearest to Russian territory. The question to be resolutely faced by the British is whether Russia shall be allowed to adopt the same methods as secured for her the domination of Northern China. A glance at the map shows how a Russian railway almost exactly follows the north and north-eastern boundary to the borders of Afghanistan, the terminus being the town of Kuskh.

In the matter of railways Russia stole a march upon us some ten years ago. The navigation of the Karun River is a British concession for which we paid dearly. Russia demanded a *quid pro quo*, and received the sole right of railway development for ten years. Lack of capital prevented the concession being utilised, and it has been extended. Probably when a railway is constructed it will extend from Caucasia to Teheran *viâ* Tabriz, and thence to Ispahan, Shiraz, Bushire, and Bender Abbas. To gain the advantage of traversing an ancient trade route, it might also branch off to Bagdad, and thence to Basra, by way of the line already mapped out in the Anatolian concession belonging to Germany.

Russian methods may be slow, but the goal is reached none the less surely. The Persian bazaars are crowded with Russian goods, and Meshed, which was once the centre for Anglo-Indian trade, has been converted into a Russian emporium, owing to the proximity of the Transcaspian Railway.

British Interests.

Not many decades ago British influence was paramount in Persia. Bushire was held by us, and the Persian army was officered by British officers; but we weakly yielded these advantages owing to petty annoyances. It is true that most of the 4,000 miles of telegraphs are in our hands, and the Imperial Bank is a British monopoly of great weight and value, but neither of these assist our trade as they would if they were possessed by other powers. One example of this ineptitude will suffice. The Imperial Bank possessed a road concession from Teheran to the south-east. This concession was a valuable one in a country where roads do not exist, but it was abandoned, and road concessions are now in the hands of others. Again, in the matter of a recent loan, the Persians hoped to place it in British hands; but we were not sufficiently alive to the situation, and a crisis arrived which caused the Persians to accept a Russian offer.

It may be accepted that our sole aim is to possess a fair share of the Persian markets, and to see that Persia remains a buffer state between India and Asiatic Russia and Turkish Mesopotamia. On the other hand, Russia aims at a complete conquest of the country, and the formation of a through route to the borders of our Indian Empire. This community of interests should prove a strong bond between the Persians and the British, and is one strong reason why our influence should be easily strengthened. Russia may have gained a strong hold on some of the Persian markets (sugar, tea, petroleum), but "there is much that remains for the British merchant. Persia has not yet had time to construct her own factories throughout her domains. There is a hungering market for our manufactured goods, for Manchester goods, for all the wares we supply to our Indian possessions. In Persia lies a paradise for the enterprising British merchant."

One half of the foreign trade of Persia passes north through Russia and Turkey, and the other half chiefly by way of the Persian Gulf. Most of the latter is carried on with India and the United Kingdom. The value in 1898 was about five and a half millions, of which India and Britain took quite three-fifths.

The direct trade between Persia and the United Kingdom in 1898 was:—Imports, £338,000; exports, £193,000.

SCHOOL LIFE IN HOLLAND.

JANUARY 1, 1901, will be an important date in the history of education in Holland. On that date attendance at school becomes compulsory there. How sorely compulsion is needed is proved by complaints from parts of Friesland, where the percentage of *absence* sometimes reaches 60 per cent. and above, both in upper and lower classes. During the late potato harvest, in the rural districts of Holland it was no uncommon thing to hear of 50 per cent. of the children being absent, in the lower as well as in the upper classes. While the elder children helped to dig up the tubers, the younger ones, ranging down to eight years of age, took their places as cowherds. How exhausting is the labour falling on these infants may be judged by the fact that each child looked after a number of cows, ranging from fifteen to twenty.

The tenure question is not unknown in Holland, but a dismissed teacher can appeal from the local to the provincial authorities. One of the latest developments is the case of a teacher whose uncle is a hackney carriage proprietor. In an evil moment he drove one of his uncle's cabs, and was dismissed on the ground that he was engaging in some other occupation than teaching. An appeal has been lodged with the provincial authorities, who have meanwhile ordered him to retain his post, although the term fixed by his notice has expired.

A pleasant feature of Dutch school life is the way in which the silver wedding of the teacher with his school is celebrated. What is the nature of these celebrations may be gathered from an account of one which lately took place in Rotterdam. The proceedings commenced with the singing of a song of welcome by the children. Then came the turn of the staff, who presented him with a bureau, to which the children, one of whom acted as spokesman on the occasion, added four chairs to match. Later in the day arrived a deputation of former colleagues, who presented him with a plaque; and a second deputation from the head teachers of the neighbourhood, who brought as their offering six mahogany chairs. Besides these gifts, the jubilarian received numerous other tangible proofs of respect and affection. On the next day the recipient of all these marks of kindly interest gave a treat to the children of his school. The above may be taken as a specimen of the way in which these jubilees are celebrated in Holland. Dutch scholastic journals usually reserve columns for accounts of celebrations of this nature.

Great complaints are being made in Holland of the difficulty involved in taking the whole of the examination for the teachers' certificate at one time. The low percentage of passes at the last examination seems to lend colour to this contention. This percentage varied from 56 at Amsterdam to 36 at Breda. The average of these two figures represents approximately the percentage of passes throughout the whole of Holland. It is proposed that those who have been successful in only one part of the examination should be eligible for appointment as second assistants, leaving the post of chief assistant and head teacher for those who have gained the whole certificate.

In connection with this examination, facts have transpired giving rise to grave suspicions that some of the examiners have not maintained proper secrecy with regard to the questions set. The facts cited bear a curious resemblance to those which many years ago formed the basis of the charges brought against a well-known English teacher. The Dutch Teachers' Union has addressed a petition to the government asking for a full inquiry into the alleged irregularities.

THE PRACTICAL INFANT-SCHOOL TEACHER.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

FOR INFANT-SCHOOL TEACHERS.

LAST month we took a general survey of the curriculum as it should be in an up-to-date infant school. I venture to think that the summary I then gave of a week's time-table will be found useful to some of our readers. In order that those who so desire may have all my notes on infant teaching filed, I propose to amplify the outlines already given.

Let us consider what constitutes an ideal school, as far as premises go. It is even more important to have good premises for infants than for older scholars. Infants are more impressionable than big boys and girls. Environment is a very great factor in growth. In more ways than one we must "make the infant school a pleasant place."

Every infant school should have plenty of space for the games. There should be a very large babies' room, with not more than half the floor-space taken up by desks. Better still, let one large room be kept without desks, so that the babies can play in it. This big play-room should have rocking-horses, swings, hammocks, see-saw, and toys. Very short lessons of ten to fifteen minutes each should be given, and there should be none of the serious slate work expected in the upper classes. "The mental arithmetic of the lower babies" should be utterly abolished. We must not forget that children of three in well-to-do homes are sleeping whilst those of the working classes are at school.

It is nothing short of cruelty to prepare babies for examination in such subjects as the three R's.

How to deal with the Babies' Class. You cannot train the babies successfully until you almost detach them from the rest of the school. There must be plenty of toys; and whenever any fall asleep they should never be disturbed.

Teachers of babies need to be well versed in the laws of psychology, and to know a little physiology. Quite a different stamp of discipline from what prevails with elder children must be cultivated. There must be sand trays, and as many varied occupations as you can get.

I often find only one sort of occupation—bead-threading. Why not have at least half a dozen?

They should be taught to talk. The babies' class is admittedly the most difficult in the infant school. A cheerful, talkative, and motherly teacher should be in charge. One of the chief objects is to train the babies to talk. They should be allowed plenty of liberty to speak out spontaneously. By a little coaxing you will work wonders. Talking must precede reading. In many schools the babies are kept seated too long. It is part of their education to learn to move about. Games, therefore, are the centrepiece of baby instruction.

Where your schools are small, and you have not room inside to carry out the ideas here referred to, why not take them out into the playground in fine weather?

The Babies' Room should be the most attractive one in the School. Wherever, when the inside conditions are unfavourable, it is possible, I would teach children outside in the playground. Pure air is also an important factor in the general upbringing of the child. It always seems to me we keep our infants too long in school. At any rate, we can so arrange our time-tables that we may not overtax the brain if we do keep them indoors longer than we should. Now, of all the rooms in your school, the babies' room should be the most attractive in every way. The room which gets the most light, the most sunshine, and is the warmest in winter, should be selected for the youngest.

There should be a good supply of suitable pictures on the walls, and some plants on the window-sills. Whether or not there are hot-water pipes, I like to see a fire, because it adds to the general cheerfulness of the place.

Suggestive Time-table for the Babies. Let us now consider in detail a morning's occupation for this lowest class of the infant school; and this reminds me that there is no necessity for an infant school to open at 9 a.m. I mean that, where a teacher thinks it more suitable, she can arrange to begin at, say, 9.30. It is better to begin at 9.30 with all your children present than at 9 with half of them late.

8.50–9.0—Babies assisted in undressing, and in assembling in their own room. It is not necessary for the babies to assemble with the elder scholars.
9.0–9.15—Opening of school with hymn and prayer. Children of three should not have a long Scripture lesson—if one at all.
9.15–9.30—Singing and drill.
9.30–9.45—Sand-trays for making letters. (Closing of registers.)
9.45–10.0—Conversational lesson.
10.0–10.15—Recreation.
10.15–10.30—Bead-threading. (Number incidentally taught.)
10.30–10.45—Marching and singing.
10.45–11.5—Varied occupation. Wool sorting. (Colour taught incidentally.)
11.5–11.20—Recreation.
11.20–11.35—Making letters in sand.
11.35–11.50—Conversation.
11.50–12.0—Teacher assists babies to dress. Dismissal.

As the registers are closed at 9.45, it is not absolutely necessary that the babies shall remain until 12. Then in the afternoon you arrange for a more recreative course still—if you possibly can, introducing games, short conversational lessons, and plenty of varied occupations. If you have a hammock or two and a cot, you can place the sleepy ones in comfortable quarters. All this kind of thing, whilst very necessary and pleasant for the little ones, is very exacting for the teacher. If you have some supernumerary juniors you might train one, at least, to baby work; and she could then relieve the responsible teacher occasionally. The baby class should not be a large one, as individual attention is as much needed for babies as for older scholars. The three-year-old children should therefore be taught apart from the four-year-old ones. I do not, of course, intend to advocate a rigid age classification, as used to be. There should be no slate-work. The fingers are not sufficiently formed for manipulating slate-pencils. In my notes next month I will deal at length with work for the older children of the infant school, and submit a time-table.

Answers to Correspondents.

C.H.—Having passed in the physiography, you are not obliged to take up this subject in your second year. You may take political economy and advanced chemistry if you wish; but why risk matters by breaking new ground?

D.T.—Yes, you will be able to sit. Has your name been entered on Form $\frac{1}{10}$ S.? If not, ask the clerk to write to the Board of Education for one of these forms.

W.M.—The class of the certificate depends upon the result of your examination. Those who only pass in the third division are not permitted to superintend the teaching of pupil teachers.

W.R.J.—My advice to you is to study for your degree. You will have a much better chance of an appointment with that qualification. Write to the secretary, Board of Education, for the memorandum relating to the appointment of sub-inspectors. The Irish inspectorate is certainly worth trying for. I am doubtful, however, whether you could succeed in the examination, which is a very severe one. However, write for a copy of the examination papers set for this examination. The book is one shilling, and can be obtained from Eyre and Spottiswoode, East Harding Street, Fleet Street, London, E.C.

B.C.—All children over three years of age earn grant. The attendances of those under five must be separately registered.

T.D.—No. Elementary and Advanced Physiography would

not count as *two* sciences. The rules on page 14 of the certificate syllabus are partly for students in training colleges. The list of subjects arranged under groups is not meant for acting teachers. I do not see why you should not take elementary botany as one subject.

Letters should be addressed—Inspector, care of the Editor. Replies will, as a rule, be given only in this column. Only those letters reaching me by the 3rd of the month can be answered in the succeeding number of this magazine.

ARITHMETIC IN THE INFANT SCHOOL.

BY MISS JEANNETTE G. LEGGETT.

(*Continued from page 308.*)

Sixth Stage.

IN the class corresponding to Standard I. the system of finding the result from a knowledge of the combination of the unit figures should be substituted for the method followed with senior infants. In order to do this, a few more primary combinations have to be memorised—namely, 7 + 4, 8 + 6, 8 + 5, and 8 + 3. The combination of 9 with other units is not given, as in this case the method of adding ten and decreasing the result by one is followed. In introducing the pupil to this system, a number of exercises, including several of a certain combination—say 7 and 5—are put on the blackboard. The exercises—27 + 5, 35 + 7, etc.—should be well distributed. The pupil works out the answer by the method hitherto used. He is then led to notice the similarity of the results in these cases, and thus by analogy is enabled to work by the new method. Good drill exercises in these endings are the adding of the same number, the results being noted on the blackboard—for example, 1, 5, 9, 13, 17, 21, etc. It is interesting to the child to notice how the terminations repeat themselves in cycles, also that each number has its own number of terminations before it so repeats.

Whilst these exercises are being given, notation to 1,000 should be practised on the slate, the numbers being placed in columns as for an addition sum. Sums should not be given as slate work until rapidity and accuracy in adding lines are ensured. The practice in mental addition, however, may take the form of sums on the blackboard. Carrying is explained by referring the pupil to the system of tying up the tens in bundles, and should present no difficulty. Mechanical aids, such as noting the sum of the column at the side, stroking out the figure to be placed in the answer, and placing the remaining figure in the next line, should not be allowed. They are really not aids. The child is able to do without them, and is stronger, mentally, for doing so. As regards subtraction sums, the child is provided in the third stage for working such as have the figure in every case on the top line greater than the corresponding figure to be taken away. In cases requiring the operation of equal additions or decomposition, the mode of procedure alone has to be taught, as the actual operations of subtracting involved have already been mastered.

So far the child is able to meet the requirements of the Code rationally and intelligently. The highest class in the infant school will be able to go farther. The sums themselves will be larger—in addition, involving notation to 10,000. This presents no new difficulty, as the system of notation has already been mastered, whilst the additional length of the sum only affords increased practice in it. A start may also be made in multiplication. The knowledge gained by adding the same figure, beginning with itself, will be committed to memory as the multiplication table, and simple sums given in the rule.

☞ *NEXT MONTH (February Number).*

The first of a Series of **Coloured Supplements** will appear in the New Volume of

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LEARNING LANGUAGES BY LETTER WRITING.

THE latest development in connection with the subject of International Correspondence, about which we have so often written in our columns, is the proposed publication at Easter, by Mr. W. T. Stead, of an international annual in three languages—namely, English, German, and French. The co-operation of our friend Monsieur Mieille has been secured as French editor, and Dr. Hartmann of Leipzig will undertake the German section. The contents of this international illustrated annual are briefly sketched as follows:—

1. A sketch of the scheme of International Correspondence in the three principal languages.
2. Accounts of school, home, or neighbourhood, from the scholars themselves, with photographs.
3. Original letters from scholars in the language of the foreign correspondent.
4. If possible, a story from a famous writer in each country.
5. A list which will contain the name of each prize-winner and accepted contributor, with name of school and teacher.
6. Some details of the exchange of homes.
7. Accounts by scholars of favourite school games.
8. Jokes, conundrums, etc., translated from foreign journals by the scholars.

Contributions for Annual.—Letters, accounts of photographs, *written in German*, must be sent to Professor Hartmann, 2 Fechnerstrasse, Leipzig, Germany. Those in French to M. Mieille, 59 Rue des Pyrenees, Tarbes, France. Contributions in English to be sent to the office of *Review of Reviews*, Mowbray House, Norfolk Street, endorsed "Languages."

A competition for the scholars themselves is announced, and the prizes consist of a hundred books. For conditions we refer our readers to the columns of the *Review of Reviews*.

* * * * * *

The response to M. Mieille's appeal in our columns last month is as yet small. We hope our readers will fully consider the matter while there is time, and send in their names to be included in the lists now being made up for the *Manuel Général*.

"Whatever advances the man improves the work," writes one of our contributors this month. We are aware from the entries for our French Prize Competition, and from other evidence, that many teachers in our schools recognise the value of the acquirement of a modern language as a means of widening their mental culture, and of increasing their teaching power; and we now hope that this reminder will be sufficient to induce them to participate in the benefits to be derived from this excellent and mutually recreative scheme. It is scarcely necessary to add that there is no fee whatever in connection with this International Correspondence.

* * * * * *

We should like to quote from some of the letters of thanks received by us, but space will not permit. Occasionally we get a complaint as to the failure of a teacher to keep up the correspondence, but we rarely get so amusing a letter as the following:—

"DEAR SIR,—About three months ago I sent my name up to THE PRACTICAL TEACHER Office, and asked you to put me in communication with some French correspondent. This you kindly promised to do; but as yet I have received no letter.

"If you know the man at the other end, you might let him know that I'm waiting. Or he may be expecting me to start first! If you can get me his address, I'll guarantee not to keep him waiting three months longer. He shall have his letter within a week, if I have to burst a blood-vessel in the composing of it, for I am dying to try my kind of French on a real Frenchman—a Frenchman living in France. I do not wish to meet him in the flesh—I could not bear that as yet. I do not brag about my knowledge of the French language; I've an intuition it's a modest quantity. Nobody, I believe, is aware that I pretend to any such knowledge. It's a light I hide under a bushel as yet; in fact, I'm not sure but that I might hide it under a common thimble. Still, I have a notion it would be none the worse of a little fresh air. So, if you would not have the thing flicker out altogether, just move a further extension of courtesy and connect me with France. Anybody will suit me, I think, bar the President of the Republic. I believe he is rather too variable a quantity, and the connection might lead to international complications. You never know.

"I must beg you to forgive this long letter, and, as to some extent extenuating my liberty, ask you to remember the long delay. Three months! Three months to compose an English letter! Tell him to hurry up. There's nothing to be ashamed of. If he can stand my French, I think I can stand his English.—Yours sincerely,

D. N., C——."

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SPRING EXAMINATION, 1901.

Ninth Month—January.

WORK TO BE PREPARED.

1. READING AND REPETITION.

CONTINUED oral practice for those not yet examined, and private reading of any good English classics. At least one good book should be read per month.

2. ENGLISH.

Candidates.—*Marmion*, Canto VI., lines 902–1021.

First Year.—*The Traveller*, lines 377–412. Twenty roots and meanings each week, and the derivation of all important words in the passage set for preparation.

Second Year.—*Julius Cæsar*, Act V., Scenes 1, 2, and 3. (For *Notes*, see January number, 1900.)

3. ESSAYS.

Write one or two essays each week, selecting from the following:—*Social Life in Norman Times; A Winter Evening; Snow; Fairy Tales; The "Good Old Days" compared with the Present; Autumn Flowers; The Use of Pictures in School; Patriotism.*

4. HISTORY.

Candidates.—Anne, George I., and George II.

First Year.—Henry VIII.

Second Year.—George III. (1800–1820) and George IV.

5. GEOGRAPHY.

Candidates.—Ireland: physical features, climate, and productions.

First Year.—India: physical features, climate, and productions.

Second Year.—Australia: physical features, climate, and productions.

6. ARITHMETIC.

Candidates.—General problems in proportion.

First Year.—The metric system.

Second Year.—Continue exercises in mensuration.

7. EUCLID.

First Year.—Revise definitions, axioms, and postulates, and Props. 1–10, with six deductions each week.

Second Year.—Revise Props. 19–26, with eight deductions each week.

8. ALGEBRA.

General practice. All back problems should be worked, special attention being given to factors.

Notes on the Month's Work.

1. ENGLISH.

For notes on English, see January 1900.

2. HISTORY.

Candidates.—The reign of Anne is important, because in it was continued the policy adopted under William the Third with regard to government by party and the foreign policy, which was to check the power of Louis the Fourteenth (*Le Grand Monarque*).

The chief interest centres in the War of the Spanish Succession, in which Marlborough demonstrated his superiority over all the French marshals who opposed him.

Plans of the chief battles should be prepared, and a life of Marlborough.

The other chief points are—the union of Scotland with England, which must be thoroughly understood; the rival Whigs and Tories; the trial of Dr. Sacheverell; and the Treaty of Utrecht.

George I.—Prepare a table showing his descent and right to the throne. The Jacobite Rebellion of 1715. The Riot Act. The South Sea Bubble, and Walpole's action. "Wood's Halfpence" in Ireland. Walpole's administration.

George II.—The Spanish War. The War of the Austrian Succession. The Seven Years' War. Prepare carefully the causes of each, the chief battles, the treaties and results.

First Year.—Henry VIII.—1. Foreign affairs: the Holy League; Flodden; the Field of the Cloth of Gold. 2. Internal affairs: Wolsey and his rise must be noted; but by far the most important phase of history is the progress of the Reformation. Copy and fill out in notebooks the following:—

1. Causes—
   - (*a*) The wealth and corruption of the clergy.
   - (*b*) The papal schism.
   - (*c*) The personal character of the popes—some of them extremely bad men.
   - (*d*) The sale of indulgences—opposed by Luther, who was excommunicated; hence the beginning of the movement.
   - (*e*) The invention of printing and the revival of learning opened men's minds to church affairs.
2. The Reformation in England.

   Henry was not a Reformer. In order to obtain his divorce, he cut off the English Church from Rome, but he executed at the stake alike Protestants and Roman Catholics who denied his supremacy. To vent his displeasure against the Pope, he abolished the monasteries, and helped forward the Reformation unknowingly. The chief events were:—
   - 1524. Visitation of the monasteries; forty of the smaller suppressed.
   - 1529. Fall of Wolsey.
   - 1531. Henry supreme head of the church.
   - 1533. Divorce of Catherine.
   - 1534. Act of Supremacy.
   - 1536. Suppression of the smaller monasteries.
   - 1537. The Pilgrimage of Grace. (Note that the poor people objected to the change in religion; the monasteries had been their best friends.)
   - 1538. Henry excommunicated.
   - 1539. Dissolution of the larger monasteries. "Statute of Six Articles."

3. What did the Reformers want? In what respects did they differ from the Roman Catholics?

   At first the Reformers wanted, as the name implies, to *reform* the church; they had no desire to separate themselves, but they were driven out of the church. They were called Protestants because they protested against the actions of the church. The chief points of difference were (see Statute of Six Articles):—
   - (1.) The Romanists believed in transubstantiation—that is, that the *substance* of the bread and wine was actually changed into the *substance* of the body and blood of Christ. This the Protestants opposed.
   - (2.) The Romish Church gave only the bread or wafer to the laity, and denied them the cup.
   - (3.) In the Romish Church priests were not allowed to marry.
   - (4.) They also believed in compulsory private or auricular confession.
   - (5.) They thought that saying masses for the dead would release them from purgatory.

There were many other points, but these were the ones which were debated most strongly. Each side was fiercely intolerant of the other.

Second Year.—From 1803 to 1815 the second part of the French War was waging. The chief points to be noticed are:—

1. The termination of Napoleon's hopes for an invasion of England, by the destruction of the French and Spanish fleets at Trafalgar.
2. The capture of the Cape of Good Hope.
3. The Berlin Decrees and the corresponding "Orders in Council."
4. The Peninsular War—
   - 1808. Joseph Bonaparte King of Spain. Expeditions under Sir John Moore and Sir A. Wellesley. Battles of Roliça and Vimiera, and the Convention of Cintra. Moore attacks Napoleon's flank, and prevents him from marching south.
   - 1809. Battles of Corunna and Talavera.
   - 1810. Battle of Busaco, and retreat to the lines of Torres Vedras.
   - 1811. Battles of Barrosa, Fuentes d'Onoro, and Albuera.
   - 1812. Storming of Ciudad Rodrigo and Badajos. Victory of Salamanca.
   - 1813. Battles of the Pyrenees, Nivelle, Nive, and St. Pierre. Storming of San Sebastian.
   - 1814. Victories at Orthes and Toulouse.
5. 1815. The Hundred Days, and Battle of Waterloo. Prepare a plan.
6. War between Britain and the United States.
7. Severe depression after the war. Note the enormous cost—over £800,000,000.

George IV.—1. Cato Street Conspiracy.
2. Commercial panic.
3. Battle of Navarino.

Notes on the History from 1756–1783.

The year 1756 saw the opening of the Seven Years' War, in which all the powers of Europe were concerned, and which had such an important result on

the history of England as a colonising power. The causes of the war are to be found in the War of the Austrian Succession. Frederick had seized Silesia from Maria Theresa, and had defied all the attempts of Austria to regain it. The proud spirit of the empress queen could ill brook this open robbery, and during the years 1752–1754 negotiations were carried on between her government and their hereditary foes, the French, with the view of forming a sufficiently strong coalition to compel Frederick to relax his iron grip. The result was that Russia, Austria, Saxony, and France formed an alliance to crush the overweening pride of the King of Prussia.

England was drawn into the European conflict, not that she liked Prussia, but that she disliked France. The King of England, it must be remembered, was also King of Hanover, and the latter position compelled this country to take some part in European politics. In the early days of 1756 an alliance was formed with Frederick, arranging the neutrality of Prussia and Hanover in case of war between England and France.

There were other reasons why England should go to war with France.

1. *America.*—During the past one hundred and twenty years the English had colonised the sea-board of what is now the United States. There were at this period thirteen states, under different constitutions, which had been formed for various reasons. The New England States owed their origin to the emigration of the Pilgrim Fathers; Pennsylvania, to the action of Penn the Quaker; Virginia, to the two mercantile companies; and so on. Meantime the French had founded settlements in Canada, on the St. Lawrence, on the Richelieu, and on the shores of the great lakes.

The boundaries of the English states towards the interior were not defined; there was a vast "Hinterland," covered mainly by forests, and inhabited by the Iroquois (the Five Nations). In this debatable land, where both French and English settlers penetrated in pursuit of the game, or for trade purposes, conflicts were common, and many lives were lost in the silent woods. The fur trade with the north-west was looked upon by the French as a monopoly; this, however, was not admitted by the English, who strove, and not unsuccessfully, to reap some of the rich harvest of gain arising from the trade in skins.

To prevent the English from extending their dominions westward, the French proposed to erect a chain of forts from the St. Lawrence, up the Richelieu, to Lake Champlain, thence across the high ground to the upper waters of the Ohio, down that river to the Mississippi, and thence to the French province of Louisiana, which, nominally at any rate, extended over all the country on both sides of the lower courses of the Mississippi. Had this project been carried out, the English would have been limited to the strip of country between the Alleghanies and the Atlantic. Forts were built on the Richelieu, and Fort Duquesne was erected on the Ohio. In 1755 a British force was dispatched, under General Braddock, to reduce this fort. He had obtained some reputation as a drill-master in Europe, but he was hopelessly out of place in the woods of the New World, against Indian warriors and Indian methods of fighting. The suggestions of the colonials, among whom was a young man named George Washington, were scouted, and the British soldiers, in their most unsuitable attire, were marched in close order through the woods, as they would have been in Hyde Park. The result was that Braddock walked blindly into a cleverly-concealed ambush of French and Indians, and his force was entirely cut up. This, it must be remembered, occurred before any formal declaration of war.

2. *India.*—Not only were we in conflict with the French in America, but a deadly struggle was proceeding in India. There the East India Company was gradually finding out the real state of affairs, and had already seen that it would be possible to change its position from that of a mere trading company to that of great landed proprietors. The same prospect had revealed itself to the fertile imagination of the Frenchman Dupleix, and both sides, taking advantage of the continual contests among the native chiefs, were already fighting for their own aggrandisement and the overthrow of their rivals.

In 1751 Clive distinguished himself by the siege and capture of Arcot, and during the next two years French influence in Southern India was crushed by the victories of Lawrence and Clive. (See Macaulay's *Essay on Clive.*)

There were thus, then, three separate fields in which we were compelled to wage war against the French. The chief events of the war are tabulated below:—

Date.	At Home.	Continent.	India.	America.	At Sea.
1756.	Pitt, Secretary of State.	Loss of Minorca. Prussians occupy Dresden.	Black Hole of Calcutta.	French successful in every direction.	
1757.	Byng executed.	Frederick defeated at Kolin. Duke of Cumberland defeated at Hastembeck. Convention of Closter Seven. Prussian victories at Rossbach and Leuthen.	Occupation of Calcutta. Battle of Plassey.	Unsuccessful expedition against Rochefort.	
1758.	Subsidy of £700,000 to Frederick.	Prussian victory at Zorndorf. Defeat at Hochkirchen.	Arrival of General Lally. French capture Fort St. David.	Capture of Cape Breton, Louisberg, and St. Johns. Capture of Fort Duquesne. Abercrombie fails to take Ticonderoga.	
1759.		Prussians defeated at Kunersdorf. British victory at Minden.	Eyre Coote's victory at Wandewash.	Capture of Ticonderoga. Niagara. Wolfe's capture of Quebec.	Havre bombarded by Rodney. Boscawen defeated the French fleet at Lagos. Hawke blockaded Brest. Hawke defeated French at Quiberon Bay.
1760.	Death of George II., Oct. 25. Accession of George III.	Prussian victory at Torgau.		Capture of Montreal. Submission of Canada.	
1761.	Declaration of war with Spain.	Family Compact.	Capture of Pondicherry.		Capture of Belle Isle by Admiral Keppel.
1762.	Resignation of Newcastle.				Capture of Martinique, Grenada, St. Lucia, St. Vincent, Havana, Manilla, and Philippines.

The war was closed by the Treaty of Paris, 1765. The chief clauses were:—

1. Spain to concede all points at dispute with Great Britain.
2. France and Great Britain to retire from the war in Germany.
3. In Europe.—Minorca to be exchanged for Belle Isle, Dunkirk to be dismantled.
4. In America.—Canada, Nova Scotia, Cape Breton to be ceded to Great Britain, but France to retain the right of fishing off Newfoundland and in the Gulf of St. Lawrence. (The loose wording of the latter part of this clause has led to the dispute which is still existent.)
5. In West Indies.—Tobago, Dominica, St. Vincent, Grenada to be retained by Great Britain. Guadeloupe, Martinique, St. Lucia to be restored to France.
6. In Africa.—Senegal to be retained by Great Britain, Goree restored to France.
7. In India.—The French military establishment to be given up.
8. Manilla restored to Spain, Florida ceded to Great Britain in exchange for Havana.

On the whole, England gained everywhere. French interest in America was destroyed; the East India Company entered unchecked on a career of conquest and prosperity.

(To be continued.)

3. Geography.

Sketch-maps must be continually used. See that you can answer the following:—

Candidates.—1. Why is the west coast of Ireland more indented than the east?
2. Give an account of the islands of Ireland.
3. What do you know of the climate of Ireland? What are bogs? how formed? Why is Ireland called the Emerald Isle?
4. What do you know of the fisheries of Ireland?

First Year.—1. Describe the mountain system of India. Why called India?
2. Give some account of the rivers. Why do they periodically rise?
3. Say what you can of the seasons. What are monsoons? how caused?
4. Why are irrigation works necessary?
5. What productions have increased largely under British rule, and why?
6. Contrast the Eastern and Western Ghauts.
7. What do you know of the Terai, Carnatic, Sunderbunds, Deccan, Great Indian Desert, Runn of Kutch, Elephanta?

Second Year.—1. Describe the general arrangements of the mountains of Australia.
2. Why is the interior dry? What is a creek? What is a "brick-duster"?
3. What do you know of the *native* fauna and flora (not things which have been introduced)?
4. Compare the vegetable productions of Queensland and Tasmania.

4. Arithmetic.

The metric system is very easy if a little thought is given to it. Those who work through the chapters in "Christian and Collar" need not fear any question at the examination. Should students find difficulties, they should write for assistance.

Test Questions.

1. *Penmanship.*
   Large Hand:—*Energetically.*
   Small Hand:—*How small, of all that human hearts endure,*
   The part which laws or kings can cause or cure.

2. *English.—Candidates.*
Analyse, and parse the words in italics:—

(*a*) "Ask me not *what* the maiden feels,
Left in that dreadful hour *alone.*"

(*b*) "And *such* a yell was *there*,
As if men fought upon the earth,
And fiends in *upper* air."

First Year.
(*a*) Paraphrase lines 349–360.
(*b*) Analyse, and parse words in italics:—

"*Yet* think not, *thus when* freedom's ills I state,
I mean *to flatter* kings or court the *great.*
Ye powers of truth that bid my soul *aspire*,
Far from my bosom *drive* the low desire."

(*c*) Write a character of the Dutch as depicted by Goldsmith.

Second Year.
(*a*) Paraphrase Act iv., Scene 3, lines 210–222.

"You must note beside.....
.....or lose our ventures."

(*b*) Analyse the same passage.
(*c*) Parse:—"I have as much of this in art as you,
But yet my nature could not bear it so."

3. *History.*
Candidates.—Say what you can of the causes and results of the War of the Spanish Succession.
First Year.—By what means did Henry the Seventh amass money? What was his object in so doing?
Second Year.—Explain clearly the causes which led to the loss of the American colonies.

4. *Geography.*
Candidates.—Mention ten manufacturing towns in Scotland. Describe their position, and add something about their manufactures.
First Year.—Say what you can of Afghanistan under these heads:—(*a*) People and Industries; (*b*) Government; (*c*) Political importance.
Second Year.—What do you know of the Llanos, Selvas, Pampas, El Gran Chaco, Titicaca, Aconcagua, Valparaiso, and La Plata?

5. *Arithmetic.*

Test Paper in Profit and Loss.

1. I buy an article at 6s. 5d. per cwt., and on every ton I gain £1, 13s. 4d. What is the gain per cent.? Ans. $18\frac{2}{11}$.

2. Goods are bought at 8 guineas per cwt.; one-seventh is wasted, and they are retailed at 2s. per lb. What is the gain per cent.? Ans. $14\frac{2}{7}$.

3. If 7 per cent. is lost by selling goods for £145, 6s. 3d., what would be gained per cent. by selling them for £168, 15s.?
Ans. 8 per cent.

4. A grocer mixes a number of pounds of tea at 2s. a lb. with an equal number of tea at 3s. 4d. a pound, and sells the whole amount for £12, thereby gaining $6\frac{1}{4}$ per cent. Of how many lbs. did the mixture consist? Ans. $84\frac{1}{2}$.

5. A draper's stock is worth at cost price £1803, 14s. 8d. After disposing of $\frac{3}{4}$ of it at a profit of $12\frac{1}{2}$ per cent., he determines to sell off and retire. At what percentage below cost price may he sell the remainder so as just to suffer no loss? Ans. $37\frac{1}{2}$.

6. A milk-dealer buys pure milk at $11\frac{1}{2}$d. per gallon. How much water must he add to enable him to sell it at 5d. per quart and obtain a gross profit of 100 per cent.? Ans. 15 per cent.

AUTUMN EXAMINATION, 1901.

Third Month.

WORK TO BE PREPARED.

1. READING AND RECITATION.

Ten minutes' oral practice each day, and as much general reading as possible.

2. ENGLISH.

Candidates.—Marmion, Canto vi., lines 231–350.
First Year.—The Traveller, lines 99–144, with twenty roots and meanings per week, and the derivation of all important words in the passage set.
Second Year.—Julius Cæsar, from Act ii., Scene 1, to

"Dear my lord,
Make me acquainted with your cause of grief."

All notes, meanings of allusions, derivations, etc., must be learned as the monthly portion is taken.
For full notes, see previous numbers. I have not received sufficient requests to warrant my including again the whole of the very full notes previously given, but I shall be pleased to insert any special paraphrases or notes, if students will write to me stating exactly what they want.

Essay Writing.

Send up an essay occasionally for criticism. Regular and careful practice is essential to success.
Subjects for this month:—(*a*) The Beauties of Summer; (*b*) Your Home Enjoyments; (*c*) Thrift; (*d*) A Railway Station; (*e*) Clouds; (*f*) "A rolling stone gathers no moss."

3. HISTORY.

Candidates.—Henry the Second to the end of Henry the Third.
Chief Points.—Henry the Second. Henry's foreign possessions. The quarrel with Becket and the church. Constitutions of Clarendon. Scutage, revolts, conquest of Ireland, and the legal reforms.
Henry—the first of the Angevin kings—was an able ruler, and his reign is therefore important. Coming to the throne at a time when the land was in a wretched state owing to the civil war and the weak rule of Stephen, he directed his energies to putting affairs on a more settled and methodic basis. The rapine and cruelties of the barons were put down with a strong hand. The castles—adulterine—which had been erected were pulled down. The Inquest of Sheriffs took that office from the great barons, and new sheriffs were appointed direct from the king's office, and were directly responsible to him. This deprived the barons of power which was often misused. The introduction of scutage—money payment instead of military service—was eagerly welcomed by the smaller barons, who henceforth devoted their attention more to agricultural pursuits than to fighting, and became the knights of the shire, the country gentry.
The encroachments of the church were checked, and although the unfortunate murder of Becket prevented the Constitutions of Clarendon being rigidly enforced, they were never repealed, and the lawless clergy were kept in check.
But it is to this reign that we must look for the commencement of government by *law*, as opposed to rule by force.
The institution of Justices in Eyre, or judges who went on circuit, brought justice to every man's door, instead of compelling him to follow the King's Court or *Curia Regis* for months to get a hearing. The Assize of Arms practically revived the Anglo-Saxon Fyrd, by which every man was rendered liable to serve the king.
Richard the First.—The king's share in the Crusades. England during his absence. Most candidates will have read *The Talisman* and *Ivanhoe*. These books give a very correct idea of these two points.
Every one must know what the Crusades were, why they were undertaken, what part our kings played in them, and the general results.
John.—John's usurpation. Loss of Normandy. Quarrel with the Pope on the election of an archbishop. Interdict and excommunication. (How did they differ? Why did the latter cow John when the former had no effect?) The king's misrule. The *Magna Charta* and the subsequent civil war.
Note carefully the grievances which the barons, church, and commons had against John; how they were all and for the first time united, and how the terms of the *Magna Charta* safeguarded the liberties of all classes. The loss of the French provinces was a gain, for barons hitherto Norman began to consider themselves Englishmen.
Henry the Third.—Note the three periods:—1. The king's monarchy; rule by justiciar; Hubert de Burgh and Peter des Roches. 2. The king's personal rule and the influence of favourites. 3. Control by the barons.
By far the most important incident in this reign was the summoning by De Montfort of the burgesses to the Parliament. This was the beginning of the House of Commons. In calling up the knights of the shire, De Montfort was only restoring to them a right which they had allowed to lapse.
First Year.—Henry the Second to Henry the Third. (See above.)
Second Year.—The Commonwealth.
Chief Points:—
1. *Establishment of Peace at Home.*—House of Lords and mon-

archy abolished. Executive Council of State formed. Various risings and disaffections by men who expected anarchy after the king's execution crushed by Cromwell—for example, Levellers, Agitators. Troops ordered to Ireland.

2. *Reduction of Ireland.*—Defeat of Ormonde. Storming of Drogheda and Wexford. Defeat of Rupert's fleet, and defeat of Hugh O'Neill. Cromwell's policy—"cruel to be kind."

3. *Reduction of Scotland.*—Capture and execution of Montrose. Landing of Prince Charles. Battle of Dunbar. Coronation of Charles. Battle of Worcester. Completion of pacification by General Monk.

4. *The Changes in Government.*—The Long Parliament. After Pride's Purge, The Rump. England declared a Commonwealth, May 19, 1649. Rump forcibly dissolved by Cromwell, April 20, 1653. Barebone's Parliament, July 1653. Instrument of Government drawn up by the Council of State. Parliament of 1654 dissolved in five months. Protector's sole rule till Second Parliament, September 17, 1656. Humble Petition and Advice. Cromwell as Lord Protector. Dissolution, 1658. After Cromwell's death a Short Parliament, dissolved in April 1659. The remains of the Long Parliament reinstated, May 7; expelled on October 13. Committee of Safety till December. Second restoration of the Long Parliament; dissolved, March 16, 1660. Convention Parliament met, April 14, 1660.

5. *Cromwell's Foreign Policy.*—Spirited, patriotic, and successful.

(*a*) *Holland.* Navigation Act, 1651. War, 1652. Decisive victories of Blake. Peace concluded on advantageous terms. Flag to be saluted; compensation paid.

(*b*) *Spain.* Demands made for free trade to South America and freedom of merchants from the Inquisition. Attacks the Spanish West Indies. Capture of Jamaica, 1655. Capture of the Plate Fleet in Santa Cruz, 1657. Capture of Dunkirk, 1658.

(*c*) *France.* Alliance, 1654. Commercial treaty, 1655, after liberty of worship had been granted to the Vaudois on Cromwell's insistence.

(*d*) Blake destroyed the pirate fleet of Tunis.

6. Note the cause of the sudden collapse after Cromwell's death—the usurpation of power by the army, and General Monk's action.

4. Geography.

Candidates.—England: productions, industries, climate. The six northern and the eastern counties in detail.

First Year.—Germany, Switzerland, and Italy.

Second Year.—Africa: British possessions.

Draw maps for each country. Analyse and tabulate in notebook all the facts to be committed to memory.

First year pupil teachers must pay especial attention to Germany and its form of government.

5. Arithmetic.

Candidates.—Application of vulgar fractions to weights and measures.

First Year.—Simple proportion.

Second Year.—Compound interest.

6. Euclid and Algebra.

First Year.—Euclid: Props. 5–8.

Algebra: Subtraction and multiplication of easy quantities.

Second Year.—Euclid: Props. 34–38, with four deductions per week.

Algebra: Addition and subtraction of easy fractions.

7. Music.

Candidates.—Accent. Two-pulse, three-pulse, and four-pulse measures.

First Year.—Quarter-pulse tones and rests.

Second Year.—Names of chromatic notes, and the principles on which they are named.

8. Teaching.

All Years.—Practise small letters on the blackboard and on paper. (Use *The Practical Teacher Copy Book* as model.)

Test Questions.

1. *Penmanship.*
   Large Hand:—*Physiography.*
   Small Hand:—*'Tis common proof that lowliness is young ambition's ladder.*

2. *English.*—*Candidates.*—Analyse lines 148–155.
Parse—*that, what, to paint, unless, were given, to dip, far less.*
First Year.—Analyse and paraphrase lines 51–62.
Parse—*as, hoards, yet, pleased, to see, so small, hope, blest.*
Second Year.—Paraphrase and analyse (end of Scene 2)—

> "Well, Brutus, thou art noble.....
> He should not humour me."

Parse—*yet, may be wrought, 'tis meet, for who so firm.*

3. *History.—Candidates and First Year.*
(*a*) Give an account of the Feudal System.
(*b*) What was the Domesday Book? When, why, and how was it compiled?
(*c*) What was the Investiture Dispute? How and when was it settled?
(*d*) In what way was Henry the First's reign favourable to the English?
(*e*) Give some account of the state of England during the Civil War.
Second Year.
(*a*) By what means did Charles raise money during his period of absolute rule?
(*b*) What were the immediate circumstances which led to the outbreak of the Civil War?
(*c*) Make a table of the chief battles fought, and the leaders on either side, and the results.
(*d*) What is meant by the Second Civil War?

4. *Geography.—Candidates.*
(*a*) Describe a coasting voyage from London to Penzance, or from Penzance to Liverpool.
(*b*) Which are the chief plains of England?
First Year.
(*a*) Give some account of the government of France.
(*b*) Say what you can of the industries of Spain.
Second Year.
(*a*) What do you know of the Congo Free State?
(*b*) What are the chief articles imported to and exported from the west coast of Africa?

5. *Teaching.*—State some rules which you would give to children for writing the capital letters B, G, M, Q.

6. *Music.—Candidates.*—What is pitch, and what do you understand by the standard scale of pitch?
First Year.—Rewrite the following without change of key:—

d r m s ˢd m t, r f t, l, s, ˢs m d

Second Year.—Name the intervals which each of the following notes makes with *each* of the others:—**d m se l.**

SCHOLARSHIP EXAMINATION, 1901.

First Month.

In commencing a new course for the Scholarship Examination, it may be necessary to point out what is attempted in these columns. In the first place, the student is advised as to the best text-books to use, for it is useless to work from an obsolete or out-of-date book. Then the work is divided into twelve monthly portions, and such notes added as space allows; a series of test questions is given each month, which are marked and criticised for the nominal sum of one shilling; and lastly, any student following this course may write at any time for assistance in a difficulty which is not considered in these pages. It is for country students—for pupil teachers that cannot enjoy the advantages of centre teaching—that we specially cater.

To any one who proposes to follow the course prescribed, we would give a few earnest words of advice:—

1. Procure good text-books.
2. Supplement your text-book by general reading.
3. Work to a regular time-table.
4. Be careful not to get into arrears.
5. Use a notebook for each subject, and enter notes, tables, analysis, etc., which should be committed to memory.
6. Above all, do not neglect such subjects as penmanship, reading, etc.
7. Obtain a syllabus (given in these pages last autumn) from the Secretary, Board of Education, Whitehall, London, S.W. It is sent gratis and post free.

The following are the subjects, marks, and suitable text-books:—

1. *Reading* (60 marks).—One of Scott's novels, or one of Macaulay's *Essays*. Text-book—*Old Mortality*, published by A. and C. Black, with notes, 1s.; or *Frederick the Great*, Macmillan, 1s. 6d.

2. *Repetition* (40 marks).—100 lines of Shakespeare or Milton. These should be selected from *Julius Cæsar*.

3. *Penmanship* (30 marks).—To write legibly. To set copies

in large and small hand. Text-book—*The Practical Teacher Copy Book* (Nelson and Sons, 1s.), specially prepared for this examination, and containing all rules as to height, size, junctions, etc., with copious exercises.

4. *Dictation* (50 marks).—Candidates should master *Words Commonly Misspelt*, Series A, B, and C. 1d. each. (Dawson.)

5. *Theory of Teaching* (100 marks).—(1) Notes of lesson. A text-book is hardly necessary for this. Taylor's *Notes of Lessons* (National Society) is a very good book. (2) Methods of teaching any subject taught in schools. *Pupil Teachers' and Scholarship School Management*, ninth edition (Nelson and Sons, 1s. 6d.). (3) The methods and principles of infant teaching.

6. *Practical Teaching* (100 marks).—To teach in an elementary school.

7. *Geography* (100 marks).—Outlines of the world, with special reference to the British Isles, India, and the chief British colonies and dependencies. *No* memory maps, but "candidates are advised to practise the drawing of sketch-maps, and to illustrate their answers by means of them." Text-books—Blackie's *Manual of the British Isles*, 1s. 6d.; Meiklejohn's *Geography* (Holden, 3s. 6d.) or Brook's *Geography* (Nelson and Sons, 3s. 6d.); Gill's *Colonies*, 2s. 6d.; *Methodic Memory Maps* (Nelson and Sons, 1s.); a good atlas, say Holden's *Comparative*, 2s. 6d. Much valuable information may also be obtained from the handbooks and official guides given away by the great shipping companies and the agents-general for the colonies.

8. *History* (100 marks).—Outlines from 1066 to 1870, with special reference to the extension of the British Empire from 1558 to 1858. Text-book—Meiklejohn's *English History* (Holden, 4s. 6d.); *Building of the British Empire* (Holden, 2s.); Blackie's *Synopsis of English History*, 1s. 6d. There are many good books which may be used for the general outlines, but the above are as good as needed.

9. *Composition* (75 marks).—To write a short essay upon a given subject. No text-book will ensure the writing of a good essay: the power to do that comes from wide reading and exact thought. Meiklejohn's *Art of Writing English* supplies all the rules and advice possible, and *One Hundred Short Essays in Outline*, by the same author, 1s., will be found most useful, especially in indicating how an essay should be divided into sections.

10. *English Language and Literature* (100 marks).—(1) Parsing and analysis of sentences; (2) elementary knowledge and a general outline of the history of the language; (3) a general knowledge of the style and subject-matter of Shakespeare's *Julius Cæsar* or Goldsmith's *The Traveller*. Text-books—any good grammar: Meiklejohn's, Nesfield's, Daniel's, Smith's, Mason's; *The Pupil Teachers' Notebook* (Nelson and Sons, 8d.); Moffatt's *Julius Cæsar*, 1s. 6d.; Macmillan's *Traveller*, 1s.

11. *Arithmetic* (100 marks).—General, with mensuration of rectangular areas and solids. Text-book—Christian and Collar's (A. M. Holden, 4s. 6d.) is the best book.

12. *Algebra* (125 marks).—As far as arithmetical progression. Text-book—Hall and Knight (Macmillan, 4s. 6d.).

13. *Euclid* (100 marks).—Books I. and II., with deductions. Text-books—any good Euclid: Hall and Stevens (Macmillan), Deighton, etc. For deductions, Egan's *Exercises on Books I. and II.*

14. *Domestic Economy* (80 marks).—Text-book—Nelson's *Manual of Domestic Economy* (Nelson, 2s. 6d.), or Newsholme and Scott.

15. *Needlework* (100 marks).

16. *Elementary Science* (100 marks).—A detailed syllabus is issued, which is covered by *Section I.* and *Section II. Physiography* (Nelson, 2s. each).

17. *Languages* (100 marks each; 200 may be taken).—Grammar, translation, retranslation, and easy unseens. Latin: *Cornelius Nepos*, Lives of Miltiades and Epaminondas. French: no set books. Text-books—Smith's *Principia* will fairly cover the Latin grammar; *Nepos* (Nelson's Scholarship Edition, 1s.). In French, any good French grammar. For reading, *Le Roi des Montagnes* (PRACTICAL TEACHER Office), or any elementary books advertised in the columns of the paper.

18. *Drawing* (60 marks).—Freehand drawing, "as recognised for an elementary drawing certificate under the Board of Education." This means outline of ornament from a photograph of a cast. Several publishers issue series of these reproductions: Nelson, Blackie, etc.

19. *Music*. Theory (20 marks).—*School Teachers' Music* (Curwen and Sons, 3s. 6d.). Practical (30 marks).—*Practical Music for Pupil Teachers* (Curwen and Sons, 6d.).

The amount of work to be got through seems immense, but it must be remembered that much of it has been done previously in the curriculum for pupil teachers, and should only need revising. Regular application, steady perseverance, and strict adherence to the course as laid down will enable any student to get through it all by December next.

Work for the Month.

1. *Reading and Repetition.*—Ten minutes' practice daily in oral work, and as much general reading as spare time will permit.

2. *Penmanship.*—Ten minutes' practice per day in copy-setting, and *care* always in all writing.

3. *Dictation.*—One exercise per week should suffice, a passage from Macaulay, or any good writer, being selected.

4. *Theory of Teaching.*—Chap. i. *Scholarship School Management.* At least *one* set of Notes of Lesson per week should be written.

5. *Geography.*—(1) Minor European and Asiatic possessions; (2) Revise France and Germany.

6. *English.*—(1) The grammar of the noun; (2) twenty-five roots and meanings per week; (3) the history of the language up to the Conquest; (4) *Julius Cæsar*, to Act I, Scene ii., line 181 (....."worthy note to-day.").

7. *History.*—The Norman kings.

8. *Composition.*—One or two essays each week, on such subjects as The Formation of Character, Newspapers and their Influence, Education, The Prospects of the New Century, Happiness and its Causes, Livingstone.

9. *Arithmetic.*—The theory up to and including L.C.M. and general problems.

10. *Algebra.*—G.C.M. and L.C.M. by factors.

11. *Euclid.*—Book II., Props. 1–4, and four deductions per week.

12. *Elementary Science.*—Matter, force, motion, and inertia.

13. *Languages.*—Latin: three pages of translation; revise the declensions. French: number of nouns; four chapters in *Le Roi des Montagnes*, or equivalent amount from some other book.

14. *Drawing.*—A freehand copy each week.

15. *Music.*—Chap. i. *School Music Teacher.*

16. *Domestic Economy.*—General physiology, position and use of the chief organs, purposes of food, processes of digestion.

CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "Mr. A. T. FLUX, The Bays, Belvedere, Kent."

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SCHOLARSHIP STUDENTS, 1901.

By C. J. Phillips, M.A.,

Latin Master, Stockwell Pupil Teachers' Centre.

THOS. NELSON AND SONS, 35 and 36 Paternoster Row, London, E.C.

OUR CERTIFICATE COURSE FOR 1901.

BY GEORGE COLLAR, B.A., B.SC.,

Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

Second Year.—1. Prepare notes of lessons on the following subjects:—

(*a*) The Manufacture of Paper.
(*b*) The Gulf Stream.
(*c*) Joan of Arc.
(*d*) Compound Interest.

2. State and illustrate the eight laws of the syllogism.
3. What is a "sorites"? To what laws must it conform?

Arithmetic.

1. Explain the terms *ratio*, *duplicate ratio*, *compound ratio*, and *third proportional*.
2. If $a : b :: c : d$, prove that $a + b : a - b :: c + d : c - d$.

English Grammar and Literature.

First Year.—1. Give an account of the Celtic element in the English language.

2. Give a summary of the subject matter of *The Revenge*, and comment on the style of the poem.

Second Year.—1. What evidence have we to enable us to fix the date at which *Henry V.* was written?

2. Explain:—*cockpit*, *cresctive*, *Gordian knot*, *lazars*; give the two senses in which Shakespeare uses the word *imaginary* in this play.

Geography.

Both Years.—1. Describe the agricultural productions of France, associating each with the district in which it is produced.

2. Give a short account of French commerce, and of the ports through which it is carried on.

History.

Both Years.—1. Compare the condition of the British navy with that of the French at the outbreak of war.

2. To what extent did the British give assistance to the insurgents against the Republican Government? Why did they not give more?

Algebra.

Women.—1. Find a number whose units digit is less than its tens digit by 2, and which is seven times as great as the sum of its digits.

2. If two-thirds of a sum of money is invested at 4 per cent., and the rest at 5 per cent., and the total interest amounts to £19, 10s., find the sum.

Men.—First Year. Solve the following:—

(i.) $\dfrac{x^2 - 1}{x + 1} + \dfrac{x(x^2 - 4)}{x - 2} = 39.$

(ii.) $x + \sqrt{(5x + 10)} = 8.$

(iii.) $x^2 + 3 = 2\sqrt{(x^2 - 2x + 2)} + 2x.$

Second Year.—1. Prove that $\log_a n^m = m \log_a n$.

2. Find four numbers in geometrical progression such that their sum is equal to 80, and of which the third exceeds the first by 16.

French.

Both Years.—1. Give the present and preterite indicative and the present subjunctive of *joindre*, *craindre*, *dire*, and *croître*.

2. Translate into French:—

She made a great effort over herself as she put up her lips to kiss him, and submitted to be gently turned round with her face towards the door of the church. Tito saw her enter; and then, with a shrug at his own resolution, leaned against a pillar, took off his cap, rubbed his hair backward, and wondered where Romola was now, and what she was thinking of him.

Translate into English:—

L'époque de William Pitt était peut-être la plus favorable que la destinée pût offrir à un talent tel que le sien. De nos jours l'auditoire d'un orateur parlementaire c'est une nation, ce sont les milliers de lecteurs à qui la presse apporte ses discours: la voix, le geste, la physionomie, ne sont pour rien dans l'effet qu'il peut produire; l'orateur est surtout un écrivain. Alors, la parole d'un député ne sortait guère de l'enceinte de la Chambre; les journaux s'abstenaient de la reproduire.

SYLLABUS AND NOTES FOR JANUARY.

English Composition.

Prepare essays on the following:—

1. Free Trade.
2. Revenge.
3. The Claims of Domestic Animals on our Kindness.

Theory of Teaching.

Second Year.—Study the methods to be adopted in giving object lessons and teaching elementary science.

Notice that no sharp line of demarcation can be drawn between object lessons and lessons in elementary science. The difference is one of degree rather than one of kind. In all lessons we aim both at training the intelligence of the pupil and at imparting knowledge, but in object lessons we attach more importance to the first of these aims, while in elementary science lessons the subject matter takes the most important place.

Object lessons should form part of a well-arranged scheme—one lesson should be related to another. It is, however, a very common fault to pay no attention to sequence, so that a lesson on a rabbit is followed by one on a lighthouse, and that in turn by one on tea.

The circular issued by the Education Department on this subject four or five years ago should be carefully studied. This circular very properly points out that there is an important difference between an object lesson and an information lesson. The former term should be used only when the object is present and the teaching is based directly upon the examination of its structure and properties. Hence, since we cannot well introduce such things as elephants and tigers into our classrooms for the children to study by direct observation, lessons on those things cannot be called "object lessons." The circular does not by any means condemn such lessons, but strongly approves of them as affording valuable information; but it points out that they should be styled "information lessons," and not "object lessons." Bût even the circular shows scanty respect for its own distinction between the two. In an object lesson we should aim at training the child's senses. An object should always be provided for the class, and, if possible, the pupils should have one each. They should be required to discover as much information as possible from the object itself. They should be taught not merely to observe the article before them, but to compare it with other objects with which they are acquainted.

Logic.—Jevons, xix.–xxi. The student must acquire a thorough acquaintance with chapters xx. and xxi. Perhaps no part of logic is more important than that which teaches us to detect fallacious reasoning, and examination questions generally contain examples of fallacies which the student is called upon to expose.

History.

In the struggle between England and France great importance was attached to the question of supremacy in the West Indies. The largest islands were not under British control, yet the great bulk of the trade was with this country, and the British West Indies were depots for the trade with Central and South America, so that about a quarter of the total commerce of Great Britain passed through the West Indies. This commerce offered the French an opportunity to harm us, if they could capture our merchant ships with their cruisers. Our plan of action, therefore, was to destroy the hostile cruisers in that part, and capture the harbours in which they had been able to take refuge and sell their prizes. French power in the West Indies had received a severe shaking by the insurrection of the negroes in San Domingo under Toussaint L'Ouverture, who made himself master of the colony, although he professed himself loyal to France. The British recognised the island as neutral, and Toussaint admitted British trade. It seemed likely that the important islands of Martinique and Guadeloupe, which had declared in favour of the Royalist cause, would put themselves under the protection of Great Britain, and Admiral Gardner sailed there in 1793; but the islands went over to the Republic, and Gardner returned to England with part of his squadron.

In November, Sir John Jervis sailed with a fleet and 7,000 men to reduce the French islands by force. After severe fighting,

Martinique submitted to him on March 22, St. Lucia on April 4, and Guadeloupe on April 20, 1794. Thus the whole of the Windward Islands passed into the hands of the British. From their position with respect to the prevailing winds, their possession was of prime importance, as (*a*) ships from them could easily bear down on parts to the west, and (*b*) ships with supplies from Europe for the other islands were obliged to pass near them, and to run the risk of capture by ships stationed there. Striving to make territorial conquests instead of maintaining naval supremacy in that part, the British weakened their garrisons in the Windward Islands to fit out an expedition against Haïti; and while the garrison of Guadeloupe was thus weakened, a French expedition arrived under Victor Hugues, and recaptured the island, December 10. Early in 1795 reinforcements were sent from France, and St. Lucia was retaken in June, and insurrection was worked up in the islands remaining under British control.

As Holland in 1794 had not only submitted to France, but formed an alliance with that country, Great Britain had to fight both countries. To overcome the rising power of France in the Windward Islands, an expedition was fitted out under Sir Ralph Abercromby and Admiral Christian; but when it sailed in November, it was scattered by a hurricane. Having refitted, it met with a similar fate on attempting to make another start in December. A few ships reached Barbadoes; others were captured by the French. Abercromby arrived at Barbadoes in March 1796, and Christian in April. The next month they attacked and captured St. Lucia, and in June St. Vincent and Grenada submitted. The Dutch settlements of Essequibo, Demerara, and Berbice were captured in the spring of this year. The unhealthy rainy season having set in, it was decided not to attempt the reconquest of Guadeloupe, which had been strongly fortified by the French, in whose possession it remained. Abercromby sent an expedition against Trinidad, which capitulated in February 1797. He then turned his attention to Porto Rico, but finding the fortifications too strong for the forces under him, he retired after losing 200 men. The Dutch colonies of Surinam and Curaçoa were captured in 1799 and 1800; and when, in 1801, Sweden and Denmark joined the French, their islands surrendered to our fleet without resistance.

By the treaty of Amiens, in 1801, Great Britain restored all her West Indian conquests except Trinidad. But having established her supremacy over the sea in that part, no difficulty was experienced in retaking the Dutch colonies on the mainland, as well as St. Lucia and Tobago, when the war broke out again in 1803. The other islands fell one after another, but Guadeloupe did not surrender till 1810.

Arithmetic.

Study the chapters on proportional parts, averages, and percentages.

The point to be remembered in proportional parts is, that if the parts of a quantity are to be in the ratio of certain given numbers, then each part is to the whole as each number is to the sum of the numbers. Partnership and partnership with time are nothing more than applications of this principle of proportional division. In the latter case, since the times vary, it is necessary to find an equivalent with unit time; thus £600 invested for three months is equivalent to £1,800 for one month.

The applications of averages are very numerous, but all depend upon the same fundamental principle.

The errors in working percentages mostly arise from neglect of the fact that a percentage is an *abstract number*. Hence percentages of *different* quantities cannot be added or subtracted any more than whole numbers or vulgar fractions of different quantities. If we wish to add ¼ of a shilling to ⅔ of a crown, we must reduce them to fractions of the same quantity, but it is useless to add ⅔ to ¼. So it is impossible to add 20 per cent. of A's selling price to 30 per cent. of B's selling price by taking the sum of 20 and 30. The student is advised to insert after a percentage the name of the quantity of which it is a percentage, although custom sanctions its omission in Profit and Loss, where a gain per cent. is always understood to be a percentage of the cost price.

The only difficulty in the preliminary rules involving percentages is that found in dealing with "covered insurance."

English Grammar and Literature.

First Year.—Study the Latin element in the English language. Nesfield draws an important distinction between Latin words and French words, the latter being those that were introduced into English after naturalisation in the French language. He groups the Latin borrowings into four periods, as most writers do; but he emphasises the fact, which many writers overlook, that during the third period—1066–1485—many words were introduced from such Latin writings as the Vulgate Scriptures, and so it is incorrect to state that these words all came through the Norman-French. To the superficial student the distinction is difficult and seemingly unimportant, but those who are familiar with Chaucer's works and other Early English literature can realise the importance of it.

Lyra Heroica, cvii.–cxii.

cvii.—*Apollo.* A son of Jupiter and twin-brother of Diana. He was worshipped under many different aspects: (1) the chastising god; (2) the god who helps man and protects him from evil; (3) the god of prophecy; (4) the god of poetry and music, hence sometimes called *Musagetes*, or the leader of the Muses; (5) the god who protects herds and flocks; (6) the god who delights in the foundation of cities; (7) the god of the sun.

Notice that the fourth aspect is referred to in this poem, although the fifth comes out in verses 4 and 5.

Helicon. The mountain in Greece sacred to the Muses.

Thisbe. A town (and valley) between Mount Helicon and the Gulf of Corinth.

The Nine—that is, the nine Muses.

Olympus. A mountain in Greece, celebrated as the abode of the gods.

cviii.—This poem is from Matthew Arnold's *Sohrab and Rustum.* The story is taken from Persian legendary history, which relates that Rustum, whose exploits resemble those of Hercules, had a son Sohrab, whose mother concealed his sex, and said that the child was a girl, fearing that Rustum would train him to be a soldier. Hence Rustum and Sohrab did not know of their relationship. When he grew up, Sohrab joined the army of the Tartar king, which eventually came in conflict with the Persian host on the banks of the Oxus. Sohrab then asked Peran-Wisa, the Tartar general, to allow him to challenge the Persian lords to single combat. When the armies are set in array, Peran-Wisa checks the Tartars, and calls upon Ferood, the Persian general, to

> "Choose a champion from the Persian hosts
> To fight our champion, Sohrab, man to man."

Ferood accepts the challenge, and sends his lieutenant, Gudurz, to induce Rustum to take it up. After some demur Rustum agrees, but decides that he will fight *incognito.* The champions meet, and each hurls his spear ineffectually at the other. Rustum then aims a blow at Sohrab with his mighty club, which the latter escapes. After a little parley they fight at close quarters, as described in our selection.

cix.—These stanzas form the last part of a poem entitled "The Scholar-gipsy." It is a kind of pastoral poem, in which the poet gives first an account of an Oxford student who, being disappointed of preferment, leaves his studies and joins a party of gipsies. The pleasures of a wandering life in the country are described, and the various persons met by the scholar-gipsy. The story is taken from Glanvil's *Vanity of Dogmatising*, written in 1661, and that is why the writer congratulates his subject on having been

> "Born in days when wits were fresh and clear,
> And life ran gaily as the sparkling Thames."

In our fourth stanza he is advised to fly the conditions that have supplanted the good old times, just as the merchant from Tyre avoided his old markets in the Levant when his commerce was ousted by that of the Greeks, and went farther west and traded with the Spaniards.

Dido. Queen of Carthage. She fled from Tyre, and settled in the north of Africa, where she founded Carthage, 853 B.C. Virgil, however, makes her Queen of Carthage at the time of the journey of Æneas from Troy to Italy, and relates that Dido put herself to death on a funeral pyre from disappointment at the departure of Æneas. But Æneas left Troy 1184 B.C.

Fly hence. The imperative is used, as the poem is addressed to the scholar-gipsy.

Chian wine—that is, wine from the island of Chios.

Tunnies. Large fish caught in the Mediterranean.

Midland. This is a literal equivalent of Mediterranean.

Syrtes. Quicksands on the north coast of Africa.

> "A boggy Syrtis, neither sea
> Nor good dry land."
>
> *Paradise Lost*, ii. 939.

Iberians—that is, Spaniards and Portuguese.

Second Year.—Read Macaulay's *Life and Letters*, chaps. xii. and xiii.

Go carefully through *Henry V.* to the end of Act ii.

11. *Law Salique.* The Salic law was originally the law of the Salic tribe, one of the Frankish peoples who settled in France.

They took their name from the Sala, now called the Yssel, near which river they formerly dwelt. Women were barred from inheriting Salic lands on account of certain military duties required of the feudal holders of those estates, not

"For some dishonest manners of their life."

The German women, on the contrary, were noted for the purity of their lives.

37. *Pharamond.* One of the knights of the Round Table, said to have been the first king of the Franks.

58. *Defunction*—that is, the death. We use the adjective *defunct*, but not the noun.

61. *Charles the Great.* Commonly called Charlemagne, from the Latin *Carolus Magnus.* The name "Charlemain" in line 75 should be Charles the Bald.

88. *King Lewis his satisfaction.* Notice that *his* is a corrupt rendering of the genitive or possessive termination *-is*, which was often written separately instead of being joined on to foreign proper names.

108. *Whiles.* An adverb formed from the *genitive* case of the noun; compare the adverb "needs" = of need, of necessity.

125-126. The first of these two lines gives the opinion of "brother kings and monarchs"—they know.....; the second states Westmoreland's own conviction. To bring this out read the passage aloud, and emphasise *hath* in line 126.

129. *Pavilioned* = encamped.

140. *Marches.* Border lands. In the early Saxon settlements the district forming the border between the Anglian settlements and the Britons was called the March-land or Mercia. Later on the noble whose duty it was to protect the Welsh borders was called the Earl of March.

144. *Main intendment* = chief attack.

160. *Impounded as a stray.* Put into prison, just as a stray ox is put into the pound.

165. *Sumless.* Unable to be totalled.

187. The comparison of the kingdom to a hive of bees is worthy of attention.

194. *Make boot.* Prey; go for booty or plunder.

203. *Executors*, not executors. The word means executioners.

226. *Ample empery.* Full empire.

252. *Gaillard* means lively, saucy—compare Château Gaillard built by Richard Cœur-de-Lion; *a nimble gaillard* means here a lively dance.

282. *Gunstones*—that is, cannon-balls, which were originally made of stone.

Act ii. Prologue 26. *Gilt*, the gold; bribery. Notice the pun with *guilt*.

61. *Hilts.* Generally used in the singular "hilt." It is from the same root as the verb "hold," and means the part by which the sword is held.

62. *Mickle.* Great. The word is often supposed nowadays to mean "little." The old proverb, "Many a little makes a mickle," is given as "Many a mickle makes a muckle," whereas mickle and muckle are really the same word.

106. *Sutler.* Camp-follower.

Scene ii. 2. *By-and-by*—that is, immediately. The phrase changed its meaning, to mark which "presently" was used; this, in turn, lost its true meaning, and "directly" came into use; and now the meaning of this word is changing.

10. *That he should.* This sentence is really subordinate to one implied, such as, "What a shame it is."

44. *Security.* Carelessness about one's safety. Lat. prefix *se* = apart, *cura* = care. This literal use of *secure* and *security* is common in Shakespeare. The ghost of Hamlet's father speaks of the hour in which he was murdered as his "secure hour."

53. *Orisons.* Prayers. (Fr. *oraison.*)

54. *Proceeding on distemper.* Resulting from a bad temper.

61. *Late*—that is, lately appointed; not in the modern sense.

66. *There is yours*—that is, your warrant or commission.

119. *No instance.* No forcible argument. Compare "Full of wise saws and modern instances."

123. *Tartar*—that is, Tartarus; generally used as the equivalent to the name Hades, the lower world. But in the *Iliad* Tartarus is represented as being as far below Hades as heaven is above the earth.

127. *Affiance.* Plighted troth; pledged affection.

153. *Forgive.* The next line shows that this word is synonymous with remission of punishment, as it is commonly taken to be.

159. *In sufferance.* Whilst suffering the due punishment.

Scene iv. 8. *Defendant.* The Norman-French influence introduced the ending *-ant* for present participles; as such it fell out of use, but it is still used as an adjectival suffix.

39. *Ordure.* Dung; mulch. The name *manure* has been only recently applied to this: to manure a field meant originally to till it by hand.

70. *Spend their mouths.* Bark.

101. *If requiring fail.* If requests are unsuccessful.

1 12. *Bowels.* Compassion. (See Gen. xliii. 30, and 1 Kings iii. 26.)

132. *Louvre.* A royal palace in Paris, now used as a museum.

GEOGRAPHY.

BOTH YEARS.—Draw a sketch-map of the West Indies, and trace out the course of the war as related in this month's History course.

Study in detail the geography of Germany. In studying the general build, notice that the surface forms three great terraces or belts at different average heights. The mountainous region in the south has the Fichtel Gebirge as its nucleus. To the *east* of this lie the Bohmer Wald, Erz Gebirge, and Riesen Gebirge, all rich in minerals. Connect with this the industrial importance of Silesia and Saxony; note the chief towns. To the *south-west* are the Schwarz Wald, or Black Forest, the Swabian Alps, and Franconian Jura. In fact, the whole of Bavaria may be regarded as a tableland, with higher land rising on it. To the *north-west* lies a well-wooded district, including Thuringer Wald and the Harz Mountains. This district is well supplied with coal, and hence is the seat of important manufactures; spinning and weaving are carried on here, and iron and steel goods manufactured. The celebrated Krupp guns are made at Essen. The north and central parts of Germany form part of the great European plain. Study the character of the low-lying shores to the *north*. Notice that the eastern and western boundaries are artificial, and hence the frequent modifications referred to in the historical sections of these notes. The agriculture, manufactures, and commerce of Germany are all important, and must be thoroughly studied.

ALGEBRA.

WOMEN.—BOTH YEARS.—Simultaneous equations. Notice in connection with this subject that there must be as many independent equations as there are unknown quantities. In solving an example with two unknowns, our object is to form one equation with one unknown from the two equations with two unknowns.

MEN.—FIRST YEAR.—Revise chapter on indices, and read that on surds. Carefully compare the proofs of theorems in the two notations, and work plenty of examples.

MEN.—SECOND YEAR.—Further exercises in logarithms, and study their application to calculation of interest and present worth at compound interest.

EUCLID.

WOMEN.—FIRST YEAR.—To end of Book I.

WOMEN.—SECOND YEAR.—Revise to end of Prop. 34, and work deductions.

MEN.—FIRST YEAR.—To end of Book III.

MEN.—SECOND YEAR.—Revise Book II., and work deductions on it.

Any difficulties may be sent up.

LATIN.

See THE PRACTICAL TEACHER Matriculation Course.

FRENCH.

Learn the irregular verbs of the fourth conjugation.

For practice in French reading, go through *Le Voyage autour de ma Chambre.* It is a short work, but it is the style of book you should be familiar with; it was set as the certificate author the year before last. THE PRACTICAL TEACHER edition has some useful exercises at the end.

☞ DURING 1901

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LONDON MATRICULATION.

JUNE 1901.

BY R. C. B. KERIN, B.A. (LOND.),

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LATIN COURSE FOR JANUARY.

1. Sallust, *Catiline*, chaps. 45–57.
2. Grammar.—Prepositions and conjunctions; irregular verbs of the first and the second conjugation; the uses of the participles, supines, infinitives. Revise the declensions.
3. *Anglicè Reddenda*, Nos. 48–58.
4. Sentences from Bradley's *Arnold* or Bayfield's or Allen's *Exercise Book*.

Notes on Grammar.

The supines are really the accusative and ablative respectively of a verbal noun. The supine in *um* is chiefly used to express purpose after a verb of motion, and is a relic of the old usage of the accusative without a preposition to express "motion to."

Some consider, however, that the supine in *u* is a dative case. It is formed generally with adjectives—for example, *iucundus, credibilis, incredibilis, mirabilis, difficilis, facilis*, etc.—to express in *reference to what action* the quality expressed by the adjective suits the substantive qualified by this adjective—for example, *difficile est dictu quanto in odio simus*, "it is difficult to say how greatly we are hated." *Fas* and *nefas* are also found with the supine in *u* of *dicere* very commonly in Cicero. The student must remember that there is only a very small number of verbs possessing a supine in *u*. To replace the supine in *u* the commonest method is to use the infinitive active—for example, *non est facile hunc invenire*.

A Latin verb does not possess as many participles as an English verb. For example, I have pointed out already in the notes that the perfect participle active is wanting, except in deponent verbs, and I have mentioned the substitutes for it. Remember that often in English a present participle is equivalent to a perfect participle; and in turning sentences into Latin, be careful not to use the present participle except when the time of the action denoted by the participle is the *same* as that of the verb to which it is attached. For example, "Hearing this, he went away," will not be translated by *hoc audiens abivit*, but by *hoc audito abivit*, as the action denoted by "hearing" is antecedent to that denoted by the verb "go away." Note how a "when" clause is often neatly turned by a present participle in agreement with the direct or indirect object of a verb—for example, in a sentence given at matriculation, "He gave me money when I did not ask for it," *Mihi non roganti pecunjam dedit*, and "He blamed Caesar when absent," *Caesarem absentem culpavit*.

The uses of the gerund and gerundive are very important. In form the neuter of the gerundive is the same as the gerund. The gerund is, however, a verbal noun supplying the oblique cases of the infinitive, is active in meaning, and governs the same case as the verb from which it comes.

The genitive of the gerund is used after nouns and adjectives in answer to the question "what kind of?"—for example, *ars scribendi*, "the art of writing;" and also after certain adjectives, as *cupidus*, etc. The dative of the gerund is used to denote work contemplated, generally in legal phrases. The accusative is used with the preposition *ad* to express a purpose. The ablative is used to denote the instrument or means. Sometimes it is used with the prepositions *in, ab, ex, de, pro*. For example, *nullum tempus illi unquam vacabat aut a scribendo aut a cogitando; voluptas quam ex discendo capit*.

Uses of the gerundive:—(*a*) It is used as a verbal adjective, is passive in meaning, and is almost equivalent to a future passive participle—for example, *res laudanda*, "a thing to be praised" ("a thing worth praising"). (*b*) It is used as a finite verb with the parts of *sum* to denote necessity, agreeing with its subject. The agent is expressed by the dative. In English we prefer to use the active in translating. For example, "We must say these things." *Haec nobis dicenda sunt* (literally, "These things are to be said by us"). This is one of the ways of translating "must" into Latin. If the Latin equivalent for the English verb is intransitive—for example, "You must resist," the Latin will be *Tibi resistendum est*. Grammarians hold different views on what *resistendum* is. Most hold now that it is the nominative of the gerund, and that the literal translation is, "There is a resisting by you." Others hold that *resistendum* is the gerundive used impersonally (literally, "It must be resisted by you"). Again, in the sentence, "She who must be spared." Now, to translate this by *Ea quae parcenda est* would be utterly wrong, because *parco* is an intransitive verb in Latin, as it governs the dative; hence we should say, *Ea cui parcendum est*.

The gerundive is used for the gerund when the latter would naturally be used with an accusative case after it—for example, *spes epistulam scribendi* becomes *spes epistulae scribendae* (the accusative goes into the case of the gerund, and the gerundive agrees with it). In the accusative and ablative this change must be always effected. This was the point in the question asked a few years ago, "Correct or justify *Aedes ad deos colendum struxit*, 'He built a temple to worship the gods.'" *Colendum* should have been *colendos*, to agree with *deos*. *Aedes*, too, ought to have been *aedem*, as *aedes* in the plural means "a house."

Neuter pronouns and adjectives are not attracted when, if attracted, they cannot be distinguished from the masculine—for example, *cupido tenendi hoc*, "the hope of holding this." If *hoc* were attracted to *huius*, the latter would be confused with the masculine (= this man).

The use of the tenses of the infinitive in Latin affords difficulty to a beginner. The present infinitive denotes the same time as that of the verb on which it depends.

Diximus te esse bonum, "We said that you were good" (at the time when we made the statement). The actual words were *bonus es* (you are good). *Diximus te bonum fuisse* means, "We said that you were" or "had been good" (before we made the statement). The actual words were *bonus eras* or *fuisti*.

The perfect infinitive is not to be used in Latin unless the action denoted by it is antecedent to that denoted by the verb on which it depends. Now, students should be very careful to avoid using the perfect infinitive after the verbs *debeo, possum*, etc., since the action denoted by the infinitive cannot possibly be antecedent to the duty, possibility, etc., expressed by these verbs. Therefore, we must write in Latin, *Eum interficere potuit* (*debuit*), "He could (ought to) have killed him."

Note how the future infinitives, active and passive, are formed. The future infinitive active is formed by the future participle and *esse*, or by *fore ut* and the subjunctive, when the supine of the verb is wanting. The future infinitive passive is formed by *iri* (the present infinitive passive of *eo*) and the supine in *um*. The future infinitive is used in Latin if the time of the action denoted by the infinitive is future to that denoted by the verb on which it depends. Take, for example, the sentence, "We know that you will be praised." Here the action of "praising" is future to that of "knowing;" hence the future infinitive passive must be employed, and we write, *Scimus vos laudatum iri*, the literal translation of which is, "That there was a going to praise you." Remember that *laudatum* is the supine, not the perfect passive participle, and is not, of course, affected by the number of *vos*, which is its object. Remember, too, the use of the future infinitive after *spero, minor, promitto*. You must avoid using the infinitive as subject, except when it is the subject of (1) an impersonal verb; (2) the verb *est* with predicate—for example, *dulce est pro patria mori; hoc facere me iuvat*.

In the sentences, we have given the rules for the use of the accusative and infinitive after verbs of *sentiendi* and *declarandi*.

The historical infinitive is an infinitive found in vivid narrative. This is the only occasion in Latin where the subject of infinitive is in the nominative case. The historical infinitive is not confined to history; there are several instances of it in poetry. The classes of verbs that take the infinitive as complement are important.

Adjectives in prose, except *paratus*, do not take the infinitive as complement. Avoid expressions like *dignus hoc dicere*.

Note that the subject of an infinitive, except in the case mentioned above, is put in the accusative; but when indefinite it is generally omitted, and adjectives, etc., referring to it are put in the accusative singular—for example, *bonum esse decet*, not *bonus esse decet*.

The adjectival complement of the infinitive is, however, in the nominative, when the subject of the infinitive is not indefinite, and is not expressed—as, *Possunt esse sapientes*, "They can be wise."

Remember that verbs of fearing are followed by the infinitive in Latin when followed by the infinitive in English—as, *Timent hoc facere*, "Men fear to do this." The infinitive of exclamation is important—for example, *Eumne huic nocuisse!* "Fancy his having injured this man!"

Typical Sentences.

19. "There are few who would marry her, but there are many who would marry him."

Pauci sunt qui illam in matrimonium ducere velint, sed multae sunt qui illi nubere velint.

Notes.—(*a*) When a relative has an indefinite antecedent, the

subjunctive is used in the relative clause. This use of *qui* is called *generic*. The subjunctive is known as the *generic* or descriptive subjunctive. (*b*) "To marry" (of a man), *in matrimonium ducere* (the wife was escorted to her husband's home). "To marry" (of a woman) is *nubo*, which governs the dative.

20. "We were so pleased with our lot that we never repented of having left that beautiful city of Corinth."

Sorte nostra tam contenti eramus ut nunquam nos paeniteret Corintho ab illa urbe pulcherrima abivisse.

Notes.—(*a*) "So" before an adjective or adverb is *tam*; before verbs, *sic*, *ita*, or *adeo*. (*b*) *Contentus* is followed by the ablative. (*c*) "That" in consecutive and final clauses is expressed by *ut*. Note, however, when there is a negative in the clause, that *ut non* is used in consecutive clauses, and *ne* in negative final clauses. (*d*) *Paenitet* is used impersonally, and takes accusative of the person and genitive of the thing. If, however, in English, you have a verbal noun, as in the sentence above, use *not* the gerund, but the infinitive or a *quod* clause. (*e*) Note that when you have in English "from the city of Corinth," you say, *ex urbe Corintho*; when you have an adjective attached to the word "city," you put the name of the city first in the required case, and then the preposition *ab* or *ex* with the adjective and *urbe*.

21. "They do not know whether he has been accused of murdering his uncle."

Nesciunt num accusatus sit quod avunculum suum occiderit.

Notes.—(*a*) "Of" and a verbal noun, when depending on a verb, are never expressed by the genitive of the gerund in Latin. The general way, then, of expressing "of" and the verbal is by using *quod* (because) and a finite verb. The subjunctive will be used with *quod* if the reason given is the opinion of some one other than the speaker or writer. Consequently, in the sentence above we use *quod* and the subjunctive, as the reason given is evidently that of the people who brought the accusation (literally, "He was accused because, as they said, he murdered his uncle.") This subjunctive is called the subjunctive of *sub-oblique narration*. (*b*) "If" in a question is not expressed by *si*, but by *num*. (*c*) *Accusatus sit* is subjunctive in a dependent question. (*d*) *Nescio* is used instead of *non scio*. Avoid using *novi*, which is used of knowing a person.

Sentences for Practice.

(Readers can have their solutions corrected by sending them to Editor Matriculation Course, *P. T.*, and enclosing 7 stamps.)

1. There were some who repented of their life; there were others who said that they would never repent.
2. Who is there who knows whether he stopped a week or more in the beautiful city of Syracuse?
3. Balbus would have married Claudia if she had not married Antonius.
4. It seems that he does not know how much twice two is.
5. If you spare him to-morrow he will be extremely grateful to you.
6. Do not forget how often he said that he was weary of his life.
7. So far is he (use *tantum abest ut*) from going to Rome that he actually intends to remain a fortnight in the charming city of Naples.
8. There is no doubt that he would have put these men to death if he had not been prevented.
9. Who was it who accused your father of betraying the city to the enemy for gold?
10. May he never repent of his crimes.

Test Paper.

(Readers can have their solutions corrected by sending them to Editor Matriculation Course, *P. T.*, and enclosing 7 stamps.)

1. Give the future participle dative feminine singular and the pluperfect subjunctive third plural of the following verbs: *torqueo, torreo, mordeo, circumdo, volo, irrideo, tono, mico, spero, invideo.*

2. Give the gender, genitive singular and plural of—*torus, taurus, flamen, lis, spes, meridies, iubar, ilex, turris, cassis, pălus.*

3. Give a list of the prepositions that govern two cases, and show by examples how their meaning differs in accordance with the case they take.

4. Correct or justify—
   (1.) *Milites misit ad paccm orandum.*
   (2.) *Spes huius faciendi.*
   (3.) *Dignus est hoc promittere.*
   (4.) *Hos interficere debuimus.*
   (5.) *Non hoc face ante adventu ducium.*
   (6.) *Scit hos interfectos iri duce.*
   (7.) *Qui scit cur eos vulneravimus?*

5. How did the Romans supply the oblique cases of the infinitive?

6. How did the Latins supply the want of a perfect active participle? Give examples, and translate your examples.

ENGLISH COURSE FOR JANUARY.

1. Grammar.—Adverbs, prepositions, conjunctions, and interjections. Nesfield, pp. 87–102, 173–193, 358–369.

2. History.—From the accession of Edward IV. to the death of Henry VIII.

3. Literature.—Stopford Brooke's *Primer of English Literature*, chaps. iv. and v.

Grammar Notes.

Note how adverbs may be classified (1) according to their syntactical force, (2) according to meaning, (3) etymologically, or according to their derivation. With regard to the third classification, note that adverbs are sometimes formed (*a*) from the genitive case—for example, twice, thrice (where *ce* was originally *es*); (*b*) from the dative case—for example, whilom, seldom; (*c*) from the accusative case—for example, something, somewhat, yesterday, though most of the adverbial accusatives have now a genitive form, as always, sometimes, etc. Adverbs are also formed from nouns and adjectives preceded by a preposition—for example, adown, anew, abed, away. Adverbs are frequently formed from adjectives by adding *ly* (originally *lice*). The suffix *ling* or *long* is also used, as in sidelong. In A.S. some adverbs were formed by adding *e*. When this *e* disappeared, the adverb consequently became the same in form as the adjective. This explains why at the present day the adverb form is in some cases identical with that of the corresponding adjective. Through false analogy, many adjectives which never had an *e* attached to form the adverb had an identical adverbial form, especially in Elizabethan English.

Matriculants are often required to give a list of pronominal adverbs. A full list will be found in Nesfield, p. 361. Note on p. 362 the list of compound pronominal adverbs. A couple of years ago, in the matriculation, candidates were required to give rules to determine the position of adverbs. Briefly stated they are—The qualifying adverb precedes (1) an adverb, adjective, preposition, and conjunction; (2) the adverb follows immediately the intransitive verb which it qualifies; (3) if the verb is transitive, the verb modifying it is placed either before the verb or after the object of the verb. The adverb occupies first position in the sentence when it qualifies the whole sentence, or when it is used emphatically.

Note in § 224 how adverbs are compared. Learn the definitions of adverbs, prepositions, conjunctions, and interjections. Note in § 532 the origin of adverbs, in § 544 the origin of prepositions, and in § 549 the origin of conjunctions. Learn the methods of classifying conjunctions and prepositions. On p. 96, footnote, read carefully the discussion as to whether conjunctions can join words as well as sentences. Note § 240 that, strictly speaking, an interjection is not a true part of speech, since it does not affect the construction of a sentence. On p. 102, note l, learn the different ways in which interjections have come into being—(*a*) from sounds expressive of the feelings, (*b*) from phrases which in course of time have been cut down.

GEOMETRY COURSE.

Read Book III., the first fifteen propositions.

Solutions to questions:—

1. The converse of I. 17 is Axiom 12, which states that if angles ABC, ACB be together less than two right angles, BA, CA will meet if produced, and thus form a triangle.

Referring to the figure of I. 17 in Hall and Stevens, if E be any point in BC, ∠ AEB is greater than ∠ ACB, and ∠ AEC is greater than ∠ ABC (I. 16).

Adding, we obtain required proof.

2. Bisect FC in G.

Then, since FC is bisected in G, and BC in D,

∴ GD is parallel to BF or EF.

Again, AD is bisected at E, and EF is parallel to DG.

∴ AG is bisected in F.

∴ AF = FG = GC.

Read Section IV. on parallelograms at the end of Book I. in Hall and Stevens.

Riders:—

1. Through a given point inside a circle, to draw the least possible chord.

2. Describe a circle passing through two given points, and having its centre on a given straight line.

ARITHMETIC COURSE.

Chapters xxvii. and xxviii. of Pendlebury.

Solution to example :—
A book sold for 9d. is published at 12d.

$$\therefore \text{ A book sold for 3s. is published at } \frac{3 \times 12}{9}\text{s.} = 4\text{s.}$$

Example :—
A man mixes 3 lbs. of tea at 2s. a lb. with 4 lbs. at 3s. a lb.; at what price should he sell the mixture so as to gain 5 per cent. on his outlay?

ALGEBRA COURSE.

Chapters xxiii. and xxiv. of Hall and Knight.
Solution to example :—

$$(x^2 + y^2 + z^2 - xy - xz - yz)^2 - (x - y)^2 (y - z)^2$$
$$= (x^2 + y^2 + z^2 - xy - xz - yz)^2 - (xy - xz - y^2 + yz)^2$$
$$= (x^2 + z^2 - 2xz)(x^2 + z^2 + 2y^2 - 2xy - 2yx),$$
by formula $a^2 - b^2 = (a + b)(a - b)$
$$= (x - z)^2 [(y - z)^2 + (x - y)^2].$$

Example :—
There are two numbers, each of two digits, the second number being composed of the same two digits, but in reverse order; prove that the difference of the squares of the numbers is equal to ninety-nine times the difference of squares of digits of either.

SCIENCE AND MECHANICS.

In Science, chapter xi. of the Mechanics portion of Brigg's *General Science*, and chapters iii. and iv. of the Chemical part.
In Loney's *Mechanics*, chapters iv., xiv., xix., and plenty of examples.
Mr. Cartwright's articles in this journal should be carefully followed and read.

1. A body of mass 10 lbs. is 9 feet above the surface of some water 9 feet deep. It is let fall and reaches the ground with a velocity of 32 feet per second. What is the average resistance of the water (that is, the resistance of the water supposed uniform)?
Here a mass of 10 lbs. is 18 feet from the ground, or possesses 180 foot-lbs. of energy.
On reaching the ground it has a velocity of 32 feet per second, and so possesses $\frac{1}{2} \times 10 \times 32^2$ ($\frac{1}{2}mv^2$) foot-poundals of energy, or 160 foot-lbs. It has thus lost 20 foot-lbs. of energy, which has done work against the average resistance R lbs. of the water through the depth 9 feet.

$$\text{Hence } 9\text{ R} = 20,$$
$$\text{or R} = 2\tfrac{2}{9} \text{ lbs.}$$

Note also the following method :—
The velocity of the 10 lbs. on reaching surface of water is found thus—

$$v^2 = 2gs = 64 \times 9.$$
$$\therefore v = 24 \text{ feet per second.}$$

It has then on entering the water a velocity of 24 feet per second, so that

$u = 24.$
$s = 9.$
$v = 32.$
$f = ?$

$$v^2 = u^2 + 2fs.$$
$$\therefore 32^2 = 24^2 + 18f,$$
giving f the acceleration in the water to be
$$\frac{224}{9} \text{ foot-seconds}^2.$$

Now, if R lbs. be the required resistance, the force causing the downward motion of the body in the water is
(10 − R) lbs., or 32 (10 − R) poundals,
so that by the equation

$$\text{P} = mf \text{ we get}$$
$$32\,(10 - \text{R}) = \frac{10 \times 224}{9}, \text{ giving, as before,}$$
$$\text{R} = 2\tfrac{2}{9} \text{ lbs.}$$

2. The perimeter of a rectangular field is a mile, and the sum of its diagonals is $\frac{3}{4}$ of a mile. Find its area in square yards.
Let x yards = its length.
y yards = its breadth.

$$\therefore \sqrt{x^2 + y^2} = \text{length of either diagonal.}$$

Noting that 1 mile = 1760 yards and $\frac{3}{4}$ mile = 1320 yards, we get the equation

$$2x + 2y = 1760, \text{ or } x + y = 880. \quad . \quad . \quad . \quad . \quad . \quad (1)$$
$$2\sqrt{x^2 + y^2} = 1320, \text{ or } \sqrt{x^2 + y^2} = 660. \quad . \quad . \quad . \quad . \quad (2)$$

Squaring these equations we get

$$x^2 + 2xy + y^2 = 880^2. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$
$$x^2 + y^2 = 660^2. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Subtracting (4) from (3)

$$2xy = 880^2 - 660^2 = (880 + 660)(880 - 660)$$
$$= 1540 \times 220.$$
$$\therefore \text{area} = xy = \frac{1540 \times 220}{2} = 169{,}400 \text{ square yards.}$$

3. The density of cork being ·25, what force will be required to keep 10 grams of cork immersed in water?
When the cork is immersed, it is acted on by forces.
(1) Its weight 10 grams vertically down.
(2) The unknown force P grams also vertically down.
(3) The weight of water displaced or the weight of an equal volume of water vertically up.
This last force = 10 ÷ ·25 = 40 grams, as is readily seen, also from fact that cork is one-fourth the density of water.

$$\therefore 10 + \text{P} = 40.$$
$$\therefore \text{P} = 30 \text{ grams.}$$

4. A man sells out 3 per cent. corporation stock at £102, and buys 4 per cent. railway debentures, increasing his income by 2 per cent. Find the price of the latter.
Originally £102 brought in an income of £3; this £3 increased by 2 per cent. would be $£\frac{3 \times 102}{100}$ or $£\frac{306}{100}$.
Hence, in the second case, $£\frac{306}{100}$ is to be the income brought in by £102.

$$\therefore \text{£4 would be the income on } £\frac{102 \times 4 \times 100}{306}, \text{ or £133}\tfrac{1}{3}.$$

$\therefore$ £133⅓ is the price of the latter stock.

5. A chain 20 feet long and of mass 200 lbs. hangs vertically; how many foot-lbs. of work are required to raise the whole chain to the level of its upper end?
The chain being supposed uniform, its centre of gravity is 10 feet below its upper end, and hence the centre of gravity has to be raised 10 feet.

$$\therefore \text{work required} = 200 \times 10 = 2000 \text{ foot-lbs.}$$

6. A body weighs 14 lbs. in air, 12 lbs. in water, and 12 lbs. 6 oz. in another liquid; find the specific gravity of this liquid.
Here weight of water displaced = 14 − 12 = 2 lbs., or weight of a volume of water equal to volume of body = 2 lbs.
So, also, weight of a volume of liquid equal to volume of body
= 14 − 12⅜ = 1⅝ lbs.

$$\therefore \text{specific gravity of liquid} = \frac{1\frac{5}{8}}{2} = \frac{13}{16} = \cdot 8125.$$

QUERY COLUMN.

RULES (as usual).

Ralpho.—1. Perhaps the best book for your purpose on dynamics is Blaikie's *Dynamics*. It is the one generally used for the University Preliminary Examinations. 2. De Fiva's *Manual of French Conversation*, published by Crosby, Lockwood, and Co., is the best book for what you want in French conversation.

Oxygen in Hot Stars (*Theta*).—This subject is referred to in *Proceedings of the Royal Society*, Vol. LXII., p. 417; in *The Astrophysical Journal*, Vol. VII., p. 367; and *Proceedings of the Royal Society*, Vol. LXIV., p. 396. A note will be given on the subject next month. Memoir on diamond in meteorites has not yet been traced.

W.R.—The rules of syntax in Allcroft and Haydon's *Latin Composition* (University Tutorial Press, 2s. 6d.) are dealt with from the point of view of translation into Latin. It is therefore better, though of course not absolutely necessary, to learn the rules also from a book, such as the *Tutorial Latin Grammar* (University Tutorial Press, 3s. 6d.), where they are given from the Latin standpoint.

Honours Physiography (*W.M.*).—You should have a thorough acquaintance with every section of Gregory's or Thornton's *Advanced Physiography*. This, however, will not be anything like sufficient. *Honours Physiography*, by Gregory, published by Messrs. Nelson at six shillings, should also be carefully studied, in addition to which you must possess an up-to-date acquaintance with the geology of the earth's crust, meteorites, spectrum analysis, and meteorology. There is no book covering the ground exactly, so that we can only recommend a perusal of the pages of *Nature*, excellent for spectrum analysis and astronomical questions in general, *The Observatory*, *The Astrophysical Journal*, *The Geological Magazine*, and any other journals likely to contain recent research notes.
To sit, you must make application to the local secretary, whose address will be furnished by the Secretary, Board of Education, Whitehall, S.W., if you are unacquainted therewith.

Honours.—There is no prescribed work for Honours English or French Leaving Certificate. The reply to *Ythan* may

help you so far. Of special French books that should be known, we would recommend (1) Brachet's *Historical French Grammar*, or (2) Darmesteter's, Part II. (this book is in French). (3) Keene's *French Literature* (University Extension Manual Series) is an exceedingly good book for those who already know the main outlines of the literature. Saintsbury's book is a trifle formidable. Reading must be fairly wide, and thoroughly idiomatic in translation. Slip-shod English is fatal to success in the Honours Examination. Try to read one work of each of a selected list of pre-eminent writers; and with the aid of such critiques as you find in Keene or Saintsbury, exercise yourself in comparing and criticising writers and periods. Extraneous reading through French journals or magazines, etc., is very helpful.

For English Honours, see reply to *Honours*.

For Mathematics, best plan is to consult Bluebook (Scotch Education), where, under the head of Secondary Education, you will find the syllabus of the work prescribed for Honours. It is too long to give here. The two following text-books you had better get: Chrystal's *Algebra* and Third's *Modern Geometry*.

London University.—A small accumulator has a "capacity" of 14 ampère-hours. What is, theoretically, the least weight of PbO_2 on its positive plates, given that the PbO_2 is reduced to PbO, and that (*a*) the electro-chemical equivalent of hydrogen is ·00001038 gram per coulomb, (*b*) the atomic weight of lead is 207, and that of oxygen is 16.

Calculate also how much heat is evolved during the whole discharge of this cell through a total resistance of 10 ohms, the average electromotive force being taken as 2 volts.

(Inter. B.Sc., London, 1900.)

During the passage of 1 ampère for one second through acidulated water, ·00001038 gram of hydrogen would be evolved.

In the case where a positive plate covered with PbO_2 is used, this hydrogen combines with oxygen obtained from the reduction of PbO_2, and water is formed. According to the data given, the equation of the reaction will be

$$PbO_2 + H_2 = PbO + H_2O.$$

Hence, for every two atoms of hydrogen liberated during the discharge, one molecule of PbO_2 must be reduced to PbO. Since the atomic weight of hydrogen = 1, we have—For every 2 grams of hydrogen liberated during the discharge $\{207 + (2 \times 16)\} = 239$ grams of PbO_2 must be reduced.

With a capacity of 14 ampère-hours, a current of 1 ampère could be generated during 14 hours. During this time the mass of hydrogen which would be liberated (if the PbO_2 were absent) would be equal to

$$14 \times 60 \times 60 \times \cdot00001038 = \cdot523 \text{ gram.}$$

Hence the least quantity of PbO_2 which would suffice for this discharge is

$$\frac{239}{2} \times \cdot523 = 62\cdot2 \text{ grams.}$$

If a cell of E.M.F. = E = 2 volts is discharged through a resistance R of 10 ohms, the current C produced

$$= \frac{E}{R} = \frac{2}{10} = \cdot2 \text{ ampère.}$$

Work (in ergs) done $= (C \times 10^{-1})^2 \times R \times 10^9 \times t$, where t = time (in seconds) occupied by discharge. Also, since 1 ampère can flow for 14 hours, ·2 ampère can flow for

$$\frac{14}{\cdot2} = 70 \text{ hours.}$$

Hence, $t = 70 \times 60 \times 60$ seconds.

Hence, work done during discharge

$$= (\cdot2 \times 10^{-1})^2 \times 10 \times 10^9 \times 70 \times 60 \times 60$$
$$= 4 \times 10^{-4} \times 10^{10} \times 2\cdot52 \times 10^5$$
$$= 10\cdot08 \times 10^{11} \text{ ergs.}$$

Since one unit of heat is equivalent to 42×10^6 ergs, we have—Total quantity of heat generated during discharge

$$= \frac{10\cdot08 \times 10^{11}}{42 \times 10^6} = 2\cdot4 \times 10^5 \text{ units of heat.}$$

The same result may be obtained if we notice that the total quantity of electricity which the cell can discharge is $(14 \times 60 \times 60)$ coulombs, or 5040 C.G.S. units of quantity. During the discharge of this quantity of electricity at a voltage of 2 volts, the work (in ergs) done will be equal to

$$2 \times 10^8 \times 5\cdot04 \times 10^3 = 10\cdot08 \times 10^{11} \text{ ergs,}$$

the result obtained above.

Notice that the total amount of heat produced during the discharge is independent of the resistance of the circuit. The resistance of the external circuit only affects the relative amounts of work done outside and inside the cell respectively. Since the resistance of the external circuit (10 ohms) is probably great in comparison with that of the cell, the total fall of potential (that is, 2 volts) will occur in the wire. The reason for mentioning the resistance of the external circuit was probably due to the fact that if a secondary cell is discharged through a very small resistance, the surface of the layer of PbO_2 becomes completely reduced, and the layer of metallic lead so formed protects the lower layers of PbO_2 from the nascent hydrogen, so that the cell cannot be completely discharged.

Perplexed.—A sphere of glass of radius R has a concentric spherical cavity of radius r. A pencil of parallel rays is directly refracted through the shell. Show that the distance of the geometrical focus from the centre of the spheres after emergence is

$$\frac{1}{2}\frac{\mu}{\mu - 1} \cdot \frac{Rr}{R - r},$$

where μ is the index of refraction.

(Elementary Geometrical Optics, Aldis, p. 89, Example 3.)

We have not been able to verify the formula given. When $(R - r)$ is small in comparison with R or r, the distance of the focus from the centre of the sphere is given to a close approximation by

$$\frac{1}{2(\mu - 1)} \cdot \frac{Rr}{R - r}.$$

We have tested the formula quoted by you, by calculating the position of the focus of a hollow glass sphere from first principles, and then by the formula given. The results obtained by the use of the formula were always much too large, so that its incorrectness is fairly evident.

The examples taken were as follows:—

I. R = 10 cms., r = 9 cms., $\mu = 1\cdot5$. True distance of focus to right of centre = 90 cms. Distance to right of centre calculated by formula quoted = 135 cms.

II. R = 100 cms., r = 99 cms., $\mu = 1\cdot5$. True distance of focus to right of centre = 9,900 cms. Distance to right of centre calculated by formula quoted = 14,800 cms.

III. R = 2 cms., r = 1 cm., $\mu = 1\cdot5$. True distance of focus to right of centre = 1·4 cms. (roughly). Distance calculated by formula quoted = 3 cms.

It may safely be concluded, therefore, that μ in the numerator of the formula quoted is a misprint for 1.

The approximate formula is obtained as follows:—

A glance at the accompanying figure will show that the two sides of the glass shell act on the incident parallel beam of light in a manner equivalent to two lenses.

Now, if u be the distance of an object to the right of a lens, and v be the distance to the right of the lens of the image formed, r_1 and r_2 being the respective radii of curvature of the right and left surfaces of the lens (r_1 and r_2 being positive, if measured to the right), then we have—

$$\frac{1}{v} - \frac{1}{u} = (\mu - 1)\left(\frac{1}{r_1} - \frac{1}{r_2}\right).$$

Considering the first refraction of the parallel beam at the right-hand side of the spherical shell, we see that

$$u = \infty. \quad \therefore \frac{1}{u} = 0.$$

$r_1 = -R$ (since the centre of curvature is to the *left* of the surface).

Similarly, $r_2 = -r$.

$$\therefore \frac{1}{v} = (\mu - 1)\left(\frac{1}{r} - \frac{1}{R}\right).$$

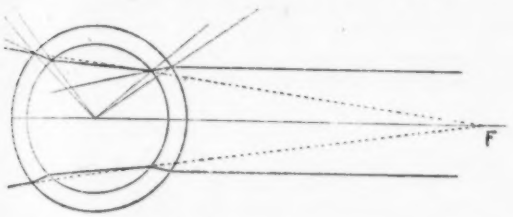
(In obtaining this formula, we neglect the thickness of the glass.)

v will generally be so large (except in the case of a thick spherical shell of small external diameter) that we may take the distance of the virtual image from the left-hand side of the glass shell as v ($v + r + R$ would be the correct distance). Hence, if v' be the distance of the virtual image, F, measured to the right from the left-hand internal surface of the sphere, we have—

$$\frac{1}{v'} - \frac{1}{v} = (\mu - 1)\left(\frac{1}{r} - \frac{1}{R}\right).$$

$$\therefore \frac{1}{v'} = \frac{1}{v} + (\mu - 1)\left(\frac{1}{r} - \frac{1}{R}\right) = 2(\mu - 1)\left(\frac{1}{r} - \frac{1}{R}\right)$$
$$= \frac{2(\mu - 1)(R - r)}{Rr}.$$
$$\therefore v' = \frac{1}{2(\mu - 1)} \cdot \frac{Rr}{R - r}.$$

The path of the rays of light is seen clearly in the accompanying figure. This is drawn to scale for a spherical



shell, of which R = 5, and $r = 4$, the value of μ being taken as 1·5. The thick lines show the path of the light rays from right to left, the thin lines being those used in the construction. If a ray, travelling in air, falls on the surface of the glass, making an angle i with the normal to the surface (in this case with the radius of the sphere), then the angle r which the refracted ray will make with the normal is given by the equation

$$\sin i = \mu \sin r.$$

A beam travelling in the glass, and incident on the surface at an angle i' with the normal, will be refracted into the air at an angle r' with the normal, where

$$\sin i' = \frac{1}{\mu} \sin r'.$$

Hence, by the aid of a protractor and a table of sines, a diagram such as the accompanying one can easily be constructed. Such exercises are to be recommended to those teaching optics to boys, as they lead to an understanding of the laws of the subject such as could not be imparted otherwise.

Ralpho.—Bisect a triangle by a line drawn through any point inside the triangle.

We are not aware of any construction the proof for which can be made to depend on Book I. and Book II. only. If it were permissible to use Book VI., we could give you a solution. We advise you to write to the author of the book from which you have taken the problem.

Bene.—If a, b, c be three quantities such that a is the arithmetic mean between b and c, and c the harmonical mean between a and b, show that b is the geometrical mean between a and c, and that a, b, c are either equal or proportional to 1, − 2, 4. (Camb. Senior, 1898.)

From the first statement

$$a = \frac{1}{2}(b + c) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

From the second statement, $\frac{1}{a}, \frac{1}{c}, \frac{1}{b}$ are in arithmetical progression; therefore,

$$\frac{1}{c} = \frac{1}{2}\left(\frac{1}{a} + \frac{1}{b}\right), \text{ or } c = \frac{2ab}{a + b} \quad . \quad . \quad . \quad (2)$$

To show that b is the G.M. between a and c, we must show by the aid of (1) and (2) that

$$b^2 = ac, \text{ or } b = \sqrt{ac}.$$

Surely this is straightforward. The fact that we require ac suggests multiplying (1) by (2). Thus—

$$ac = \frac{b + c}{2} \cdot \frac{2ab}{a + b} = \frac{(b + c)ab}{a + b}.$$
$$\therefore (ac)(a + b) = (b + c)ab.$$
$$\therefore ac = b^2, \text{ on simplifying} \quad . \quad . \quad . \quad (3)$$

Using (3), (1) may be written—

$$a = \frac{1}{2}\left(b + \frac{b^2}{a}\right),$$

which gives $2a^2 = ab + b^2$,

from which we can find neither a nor b, but $\frac{a}{b}$, by dividing throughout by b^2. Thus—

$$2\left(\frac{a}{b}\right)^2 - \left(\frac{a}{b}\right) = 1.$$

Solving this quadratic for $\frac{a}{b}$ we obtain

$$\frac{a}{b} = 1, \text{ or } -\frac{1}{2}; \text{ that is, } a = b, \text{ or } -\frac{b}{2}.$$

Now, a cannot equal b, from the first statement of the problem; therefore

$$a = -\frac{b}{2}, \text{ or } b = -2a.$$

Therefore from (3), $ac = 4a^2$, or $c = 4a$.
Hence a, b, c are in the ratio of
$$a : -2a : 4a, \text{ or } 1 : -2 : 4.$$

Alan Gray.—A rifle bullet hits a target. Find the locus of places at which the sound of the discharge and of the hit are heard at the same instant. (Wilson's *Conic Sections.*)

Let O be the position of the rifle, T that of the target, and P that of the observer who hears the sounds at the same instant.

Let V_s be the velocity of sound in air, and V_b that of the bullet. Then, since time = distance ÷ rate, we shall have

$$\frac{OP}{V_s} = \frac{PT}{V_s} + \frac{OT}{V_b},$$

or $$OP - PT = \frac{V_s}{V_b} \cdot OT = \text{constant}.$$

Hence P will be on a hyperbola whose foci are at O and T, the transverse axis being $V_s \cdot OT \div V_b$ (see Wilson, p. 114).

Rita.—Perform the following calculations in the simplest and least laborious way you can, making it clear what your way is:—
(*a*) 241 times 1s. 5¾d.
(*b*) ·63 of £1 + 1·37 of £1 − ·36 of a shilling − ·63 of a shilling.
(*c*) 2 hours 37 min. 37·1 sec. − 1 hour 37 min. 37·9 sec.
(*d*) The common 123 123 and 231 231.
(Arith. Exam. Paper, Pupil Teachers' 2nd Year, 1900.)

(*a*) 241 shillings = £12 1 0
241 sixpences = 6 0 6
∴ 241 times 1s. 6d. = 18 1 6
241 farthings = 5 0¼
∴ 241 times 1s. 5¾d. = £17 16 5¼

(*b*) ·63 of £1 + 1·37 of £1 = £2.
− ·36 of 1s. − ·63 of 1s. = − 1s.
Required answer = £1, 19s.

(*c*) 1 hour − ·8 sec. = 59 min. 59·2 secs.

(*d*) You have probably copied this inaccurately; it should be "common factors."

Learner.—A spring discharges water into a pond at a uniform rate. If, while water flows, 16 men pump the pond dry in 10 hours, and 12 men in 18 hours, how long will it take 10 men to do so? In how many hours will the pond be filled again?

Ans. 30 hours; 12½ hours. (Christian and Collar.)

There are three *constant* quantities to consider—(1) the quantity which *one* man can pump *per hour*; (2) the quantity which the pond will hold; (3) the supply from the spring *per hour*.

From the first statement—
10 × 16 times (1) = (2) + 10 times (3) . . . . (*a*).
From the second statement—
12 × 18 times (1) = (2) + 18 times (3) . . . . (*b*).
Therefore, by subtraction—
56 times (1) = 8 times (3).
∴ 7 times (1) = (3) . . . . . (*c*).

Or, the spring supplies seven times as much per hour as one man can pump per hour.

By the aid of the last result (*c*), the statement (*a*) becomes
160 times (1) = (2) + 70 times (1).
∴ (2) = 90 times (1) . . . . . (*d*).

Or, the pond holds ninety times as much as one man can pump in one hour.

Hence, as ten men are emptying it, and the spring is equivalent to seven men filling it, it is as if three men were trying to empty the pond when there is no spring. But the pond holds as much as ninety men can pump in one hour; hence, it will take these three men 90 ÷ 3, or 30 hours.

The spring being equivalent to seven men, it will not take so long to fill it as the three men took to empty; clearly the spring will require ⅜ × 30, or 12½ hours.

Solutions to queries sent by *F. Horton*, *D.T.S.*, and *Richmond* may be had by post.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honoursman in Chemistry.

Electro-Chemistry.—The following extract from the proceedings of the Electro-Chemistry Committee of the British Association will be very suggestive to Honours students:—"Professor G. F. Fitzgerald opened a joint discussion with the chemical section on **ions.** Whilst acknowledging that the dissociation theory of electrolysis had proved a useful hypothesis, he wished to draw attention to the fact that there were phenomena that it was incapable of explaining, and that dissociation itself had not been dynamically explained. Why should water dissociate a dissolved salt into its ions? where does the necessary energy come from? how can the dissociated ions wander about in the solvent without re-combining? and why do some ions travel faster than others? seemed to him questions which the supporters of the theory had never satisfactorily answered. The recent work on conduction in gases seemed to render it necessary to restrict the term 'ionisation' in future to the process of producing atoms differently electrified, and to introduce a new term, 'electronisation,' for the production of conductivity by the motion of particles of apparent mass, about $\frac{1}{1000}$ of that of a hydrogen atom. In gases conductivity was probably due to both causes, and in liquids to the former only. In the case of metals he should like to ask, how thick was the layer of electricity on the surface? and did the thickness of a thin plate—of a thin metal plate—alter its capacity? and would the electrons fly to the surface of a metal when it revolved? He thought the questions open to discussion might be summarised as follows:—(1) The cause and nature of ionisation. (2) The source of the energy in dissociation in a liquid. (3) The cause of the failure of the law of dissociation as the concentration increased. (4) The reason for the different rates of migration of the ions. (5) The nature of the double layers, or why different metals should attract electricity differently. (6) Are the processes of ionisation the same in liquids and gases? and if so, why? (7) Do electrons gravitate—that is, have they a material nucleus or not? (8) Is magnetism due to the rotation of the electrons?"

Dr. Larmox said that the large dielectric constant of water meant a large electric moment for the water molecule, and therefore a considerable separation of the positive and negative charges on the molecule. A molecule of dissolved salt might therefore come under the influence of one of these charges alone.

Professor Armstrong stated that in the opinion of chemists the atoms were permanent and stable, and that the removal of $\frac{1}{1000}$ of the mass of a hydrogen atom, along with the negative charge, seemed to them impossible. He thought that the same process produced conductivity in gases which produced it in liquids; that in gases the vapour of water played the part of the water in the electrolysis of a dissolved salt, and that in all cases it was necessary to form a triplet by the pressure of a third substance before any chemical or other action could result. This third substance was generally one having one of its constituents in an unsatisfied condition, like the oxygen in water or the nitrogen in ammonia, and in which there was, in consequence, a tendency towards association of molecules.

Professor Oliver Lodge thought that, although in a liquid the charges apparently travelled with the atoms, while in a gas the electrons appeared to be free, in neither case was conduction by means of molecular aggregates excluded. He considered metallic conduction the handing on of the electrons from one atom to another. He looked forward to an electrical theory of matter in which the hydrogen atom would consist simply of 500 electrons without nuclei.

Action of Permanganate on Hydroxyl.—It has been asserted by Berthelot and Bach that when these two bodies react, oxides of hydrogen higher than H_2O_3 are formed. This is denied by Herrn Baeyer and Villiger, who have had the matter under consideration. The French chemist asserts that when hydroxyl acts on permanganate at low temperatures the latter is discoloured without evolution of oxygen, and hence infers that H_2O_3 is formed. The German *savants*, on the other hand, aver that the same volume of oxygen is evolved at $-16°$ C as at higher temperatures, the only difference being that it is evolved much more slowly at the lower than at the higher temperatures. Bach also asserted that, as an excess of oxygen above the calculated quantity is given off when Caro's acid—that is, hydroxyl in H_2SO_4—acts upon permanganate, hydrogen tetroxide is contained therein. This Herrn Baeyer and Villiger also traverse; their explanation of the evolution of oxygen being that it is due to the catalytic decomposition of Caro's acid by the manganous sulphate that is produced. The view adopted as to the nature of the reaction between H_2O_2 and permanganates is that the oxygen of the latter oxidises the hydrogen of the H_2O_2, and so sets free the oxygen, and not that atoms of oxygen from each of the two bodies mutually combine to form a molecule of oxygen, as in the customary reaction between H_2O_2 and highly oxygenated bodies.

Argon and its Companions.—Professor Ramsay and Dr. Travers read a paper before the Royal Society on November 25, the subject being as above. At the outset they admit that metargon, which Professor Ramsay was credited with discovering some months back, has no existence.

Krypton, Xenon, and Argon.—To obtain the heavier gases, krypton and xenon, a large amount of liquid air was allowed to evaporate quickly; the residue was freed from oxygen and nitrogen, and then consisted of a mixture of krypton, xenon, and argon, the last forming by far the largest portion of the gas; this mixture was liquefied by causing it to flow into a bulb immersed in liquid air, and the bulk of the argon was removed as soon as the temperature rose, the krypton and the xenon being left behind. By many repetitions of this process the three gases were finally separated from each other.

Neon.—For neon the process was different. The air liquefier furnished a supply of liquid air; the gas escaping from the liquefier consisted largely of nitrogen; this mixture was liquefied in a bulb immersed in the liquid air which the machine was making. When the bulb had been filled with liquid nitrogen, a current of air was blown through the liquid until some of the gas had evaporated. That gas was collected separately and deprived of oxygen by passing over red-hot copper; it contained the main portion of the neon and the helium present in the air. The remainder of the nitrogen was added to the liquid air used for cooling the bulb in which the nitrogen was condensed. Having obtained a considerable quantity of this light nitrogen, it was purified from the gas by passing it over heated magnesium, and the argon containing helium and neon was liquefied. By fractional distillation it was possible to remove the greater portion of the helium and neon from this mixture of gases, leaving the argon behind. Many attempts were made to separate the helium from the neon. Among these was fractional solution in oxygen, followed by a systematic diffusion of the two gases; but it was not found possible to raise the density of the neon beyond the number 9·16, and its spectrum still showed helium lines. It was not until liquid hydrogen had been produced in quantity that the separation was effected: the neon was liquefied, or perhaps solidified, at the temperature of boiling hydrogen, while the helium remained gaseous. A few fractionations serve to produce pure neon.

Results.—The following tables will show the properties of the gases as ascertained by the authors, and will serve to show the

position of the elements in the periodic system of classification, which, however, is in no wise simplified by the inclusion of argon and its companions helium, hydrogen, and sodium.

Properties.

	Helium.	Neon.	Argon.	Krypton.	Xenon.
Refractivities (air =1)	0·1238	0·2345	0·968	1·449	2·364
Densities (O=16).	1·98	9·97	19·96	40·88	64·
Boiling points at 760 mm.	?	?	86·9 abs.	121·33 abs. 210·5 abs.	163·9 abs.
Critical temperature	?	Below 68° abs.	155·6 abs.	41·24 abs.	287·7 abs.
Critical pressure	?	?	40·2 mets.	0·0467 mets.	43·5 mets.
Vapour pressure ratio	?	?	0·350	2·155 grms.	0·0675
Weight of the c.c. of liquid	?	?	1·212 grms.		3·52 grms.
Molecular volume	?	?	32·92	37·84	36·40

Periodic Classification.

Hydrogen 1	Helium 4	Lithium 7	Beryllium 9
Fluorine 18	Neon 20	Sodium 23	Magnesium 24
Chlorine 35·5	Argon 40	Potassium 39	Calcium 40
Bromine 80	Krypton 82	Rubidium 85	Strontium 87
Iodine 127	Xenon 128	Caesium 133	Barium 137

Remarks on Periodicity.—That the gases do form a series is evident from the following considerations:—1. The ratio between their specific heats at constant pressure and constant volume is 1·66, showing that they are monatomic. 2. If their densities be regarded as identical with their atomic weights, as is the case with diatomic gases such as H, O, and N, there is no place for them in the table. 3. They exhibit gradation in respect to refractive index, atomic volume, melting point, and boiling point.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

The Earth's Magnetism.—Mr. William Sutherland has, in a recent number of *Terrestrial Magnetism and Atmospheric Electricity*, enunciated a theory of the origin of the earth's magnetism and of the variations presented thereby. The cause suggested is the rotation of the electrostatic field within the earth, as Rowland's experiments have shown that a moving charge of electricity produces a magnetic field analogous to that of a current. If the earth carries round an electrostatic field in its rotation, then it will have the axis of its magnetic field identical with the axis of rotation, which is the chief approximate fact of the earth's magnetism. The actual obliquity of the magnetic to the rotational axis is traced to unsymmetrical magnetic permeability of the earth, which also causes the induction of earth currents, the secular variation of whose tracks is the cause of magnetic secular variation. The theory advanced to account for daily variation is that, under the action of the sun's rays, the oxygen and ozone of the atmosphere become the active substance of a large secondary battery or accumulator, whose alternate charge and discharge are the cause of the daily variations.

Latitude 86° 33′ N.—Captain Cagni, who was in command of the sledge party sent from Rudolf Land by the Duke of Abruzzi towards the North Pole on 11th March, succeeded in reaching the eighty-third parallel on 31st March. Proceeding with three Italian Alpine guides, and travelling 9½ miles a day, they reached Nansen's furthest north—namely, latitude 86° 14′. After a long and careful observation to ascertain that this was actually the case, Cagni with his companions again set his face to the north, and finally succeeded, on April 26, 1900, in obtaining latitude 86° 33′ N. in longitude 56° E. No land was in sight—nothing but ice in a state of thaw. Cagni proved, like Nansen, that Payer's map is incorrect, neither Petermann's Land nor King Oscar Land being in the position given them by the map, or otherwise they would have been seen by the intrepid travellers, which they were not.

Kite Meteorology.—We have frequently referred to this interesting method of upper air research, and we now draw the attention of our readers to an article on the subject in *Nature* for 29th November, from which we extract the following particulars:—The kite, a figure of which appears in *Nature*, is of the form known as the Hargrave cellular kite, the surface dimensions of which vary from 45 to 72 square feet. The line consisted of steel pianoforte wire ·028 inch in diameter, and weighing 2·15 lbs. to the 1,000 feet, or 11·35 lbs. to the mile. The tensile strength of the wire at the breaking point was about 200 lbs. With a kite flying at an elevation of from 5,000 to 7,000 feet, from 8,000 to 10,000 feet of wire would be out, making a weight of from 90 to 115 lbs. to be sustained by the kite.

The Meteorograph is also figured in *Nature*. It weighs about 2 lbs., is enclosed in an aluminium case, and is capable of recording (1) pressure; (2) temperature; (3) relative humidity; and (4) wind velocity. Wind direction is, of course, evident from the flight of the kite.

Results obtained:—1. Diminution of Temperature with Altitude. The mean rate of diminution of temperature with altitude was found to be 5° F. for each 1,000 feet. The gradient was greatest up to 1,000 feet, where it was 7·4° F.; and thence up to 5,000 feet there was a steady decrease to 3·8° F. per 1,000 feet, the rate of decrease varying inversely with the altitude. Above 5,000 feet there was a tendency towards a slight increase. **2. The relative humidity** at and above the earth's surface differed but little; and, generally speaking, the upper air percentages were the lower of the two. **3. The vapour pressures** were compared with others obtained at various times at equal altitudes by means of balloons and mountain observations, and found to be somewhat lower. Differences in wind direction above and at the surface were, for the most part, confined to a deflection toward the right of the kite. This deflection frequently increased with the altitude, but rarely exceeded 90°. In some few instances, chiefly during unsettled weather, the deflection was toward the left, but not to any great extent.

In this connection we may mention a little book that has just been published by the Society for the Promotion of Christian Knowledge, entitled *Sounding the Ocean and Air*, to which we refer Advanced and Honours students.

The Infra-Red Region of Solar Spectrum.—In *Comptes Rendus* for 15th November, Professor Langley describes the result of his recent work on the bolometric study of the solar spectrum in the infra-red. In 1894 the knowledge of the region beyond $\lambda = 1\ \mu$ was very imperfect; but now, thanks to the great improvement of his bolometer, which is capable of detecting a variation of temperature as minute as the millionth part of a degree, the map of the calorific rays has been carried to $\lambda = 5{\cdot}8\ \mu$. The article is illustrated by a heliogravure of the calorific spectrum from $\lambda = 0{\cdot}76\ \mu$ to $\lambda = 5{\cdot}3\ \mu$, both the galvanometer record and the line integration being given. More than six hundred lines are recorded, each of which has been studied separately, and obtained by from six to twenty independent observations. Professor Langley calls special attention to the observation of the *telluric* infra-red spectra, which have been studied during all seasons from 1895–1900. Systematic variations have been observed in them which appear to have some relation to the season in which they occur; and although small, they are very distinct.

ELECTRICITY AND MAGNETISM.

NOTES ON ADVANCED AND HONOURS STAGE.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

Problem.—Determine the smallest terminal P.D. which will suffice to deposit silver from a solution of silver nitrate, using platinum electrodes.

Given.—Electro-chemical equivalent of silver = 108 × ·000105 = ·0113 gram per second per C.G.S. unit of current.

Heat of solution of 1 gram of silver in nitric acid = 128 heat units (approximately).

Answer.—The required P.D. = ·00113 × 128 × 4·2 × 10^7 = 6·09 × 10^7 C.G.S. units = ·61 volt (nearly).

Experiment shows that in order to decompose a normal silver nitrate solution, using platinum electrodes, the smallest P.D. is ·7 volt. This result, though differing by 15 per cent. from the calculated value, is still of the right order of magnitude.

The results obtained in the problems already solved may be used in an interesting manner to perform chemical separations. Thus, if a mixture of zinc sulphate and silver nitrate solutions be subjected to electrolysis, using platinum electrodes, the silver may be deposited by itself, if the P.D. between the terminals of the voltameter is maintained between ·7 volt and 2·35 volts. When the whole of the silver has been removed, the current will cease

to flow. If the cathode on which the silver is deposited be now removed, a fresh cathode substituted, and the terminal P.D. increased to more than 2·35 volts, the whole of the zinc may be removed.

Problem.—Determine the smallest P.D. which will suffice to decompose a solution of copper sulphate ($CuSO_4$), using platinum electrodes.

Given.—Electro-chemical equivalent of copper = 31·5 × ·000105 = ·00331 gram per C.G.S. unit of current.

Heat of solution of 1 gram of copper in dilute sulphuric acid = 881.

Answer.—The required P.D. = ·00331 × 881 × 4·2 × 10^7 = 1·22 × 10^8 C.G.S. units = 1·22 volts.

Problem.—Calculate the terminal P.D. of a Daniell cell when only an infinitesimal current is passing through it.

Answer.—In a Daniell cell zinc dissolves in dilute sulphuric acid to form zinc sulphate, whilst copper is deposited from a solution of copper sulphate. Hence the required P.D. = P.D. necessary to decompose zinc sulphate solution, *minus* P.D. necessary to decompose copper sulphate solution = 2·39 − 1·22 = 1·17 volts.

The value found experimentally varies from ·978 volt, when the zinc is dissolved in a solution containing one part by weight of sulphuric acid to twelve parts by weight of water, to 1·079 volts when the zinc dissolves in a solution represented by the formula $H_2SO_4 + 4H_2O$.

In any case where work is done during the passage of the electric current, there will be a corresponding difference of potential. When an electric current passes through a copper sulphate solution from one vertical copper electrode to another, the only work performed will be equivalent to the heat produced in the solution, the value of the work being given by

$$W = C^2Rt.$$

(We here neglect the work done in altering the concentration of the solution in the neighbourhood of the electrodes.) Copper is dissolved from the anode to form $CuSO_4$, and an equal amount of $CuSO_4$ is decomposed to deposit copper on the cathode. Hence the solution remains (to a first approximation) in its original condition; and since the copper is transferred in a horizontal direction, no work will be performed in overcoming the action of gravity.

On the other hand, if the electrodes are placed horizontally one above the other, and the current is led from the lower to the upper electrode, then copper is dissolved at the lower electrode and deposited at the upper one. Hence copper is carried upwards against the action of gravity, and work must be performed. Let us now calculate the difference of potential per centimetre distance between the electrodes, due to this action.

When 1 C.G.S. unit of current flows for one second, ·00331 gram of copper is deposited at the cathode, a similar quantity being dissolved from the anode. Since the average force of gravity on a mass of 1 gram is 981 dynes, it follows that in raising ·00331 gram of copper through a distance of 1 centimetre an amount of work is done equal to

$$·00331 \times 981 \times 1 = 3·25 \text{ ergs.}$$

Hence the difference in potential between two horizontal copper electrodes, placed the one vertically above the other, in a copper sulphate solution, at a distance of 1 centimetre apart, will be equal to $3·25 \times 10^{-8}$ volts.

Since 1 mile = 161000 centimetres, it follows that if two copper plates were placed the one vertically above the other, in a copper sulphate solution, at a distance of 1 mile apart, the resulting difference of potential would only amount to $5·2 \times 10^{-3}$ volts, or five one-thousandths of a volt. Hence it becomes evident that the difference of potential resulting from this cause may safely be neglected when we are considering ordinary cells.

If the gas generated in a water voltameter is allowed to escape into the atmosphere, then a certain amount of work is performed in forcing the gas into the atmosphere against the barometric pressure. It is interesting to determine the magnitude of the work done in such a case, so as to see whether any appreciable difference would be produced in the potential of such a cell, say by variations of barometric pressure.

When unit C.G.S. current flows for one second, a mass of ·000105 gram of hydrogen is liberated. Since ·0896 gram of hydrogen, at 0° C., and a pressure of 760 millimetres of mercury, occupies a volume of 1000 cubic centimetres, it follows that ·000105 gram of hydrogen would, in similar circumstances, occupy a volume of

$$\frac{1000 \times ·000105}{·0896} = 1·17 \text{ cubic centimetres.}$$

During the time that the atmosphere has been forced back by the generation of a volume v (in cubic centimetres) of gas, the atmospheric pressure being equal to p dynes per square centimetre, the work done* is equal to pv.

The pressure in dynes, corresponding to 760 millimetres of mercury, is equal to

$$76 \times 13·6 \times 981 = 1·01 \times 10^6 \text{ dynes per square centimetre,}$$

where 13·6 is taken as the density of mercury. Hence, during the passage of unit C.G.S. current per one second, an amount of work is performed in forcing back the atmosphere by the hydrogen liberated, and the value of this work is equal to

$$1·01 \times 10^6 \times 1·17 = 1·18 \times 10^6 \text{ ergs.}$$

Since two molecules of hydrogen are liberated to every one molecule of oxygen, the volume of oxygen liberated per second will be half the volume of hydrogen liberated. Hence the work done in forcing the atmosphere back by the liberated oxygen will be equal to $\frac{1}{2} \times 1·18 \times 10^6$ ergs per second

for every C.G.S. unit of current.

Hence total work performed per second during liberation of both gases $= (1·18 + ·59) \times 10^6 = 1·77 \times 10^6$ ergs.

The corresponding difference of potential will amount to

$$1·77 \times 10^{-2} \text{ volts.}$$

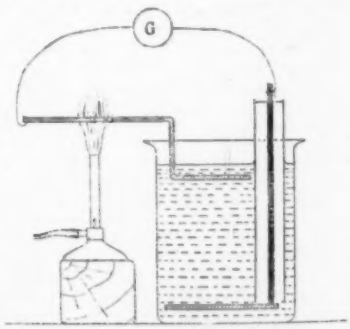
A small *variation* in the atmospheric pressure is, consequently, not likely to appreciably affect the difference of potential necessary to electrolyse acidulated water.

Difference of Potential due to Thermo-Electric Causes.—The heating of a uniform wire by the passage of an electric current is often termed the "Joule effect." It is also possible to produce important thermal effects in other ways. When an electric current passes across the junction of two dissimilar metals, heat may be either produced or absorbed, according to the nature of the metals and the direction in which the current flows. Thus, when an electric current flows from bismuth to antimony across a junction of these metals, the junction is cooled, and heat energy is converted into electrical energy. On the other hand, if the current passes from antimony to bismuth across such a junction, heat is liberated, and the junction is heated. Thus, in passing from antimony to bismuth, work must be done by the current; in other words, there will be a positive difference of potential. In passing from bismuth to antimony, heat is absorbed, and converted into electrical energy; consequently there is a negative difference of potential. This action is termed the *Peltier effect.*

Differences between Joule and Peltier Effects.—The Joule effect is irreversible—that is, in whatever direction a given electric current may flow along a conductor, the potential falls in the direction in which the current flows. This follows from the equation $E = CR$.

Heat is always liberated, and work is performed, according to the equation $W = C^2Rt$.

In the Peltier effect, if a fall of potential occurs when the current traverses a junction in one direction, an equal rise of potential will ensue when the same current traverses that junction in the opposite direction. The difference of potential E′ at



the junction must, therefore, be independent of C. We may write $E' = P$,

where P is the Peltier coefficient—that is, the work done per second per unit current passing the junction in a given direction. Consequently, work done in time t, at a junction where the Peltier coefficient is P, $= W' = PCt$.

It is not generally known that a Peltier effect can be detected between a metal and an electrolyte. The following experiment is of some interest:—

Screw a copper wire † into a copper disc, and insulate the wire

* See *Heat for Advanced Students*, by the author, p. 332.

† Solder must not be used, for obvious reasons.

by means of a glass tube. Place the copper disc at the bottom of a beaker containing copper sulphate solution, and place another electrode horizontally at a small distance below the upper surface of this solution. The upper electrode is formed from a piece of sheet copper bent twice at right angles (see figure), and placed with one portion projecting over the edge of the beaker. If this projecting portion is heated by a Bunsen flame, the upper junction of copper and electrolyte is heated, whilst the lower junction remains cold. If the two electrodes are connected with the terminals of a reflecting galvanometer, a considerable deflection will be obtained.

The Peltier effect between a metal and an electrolyte is thus found to be of a much greater order of magnitude than that between two metals.

MATHEMATICS.

STAGES 2 AND 3, BOARD OF EDUCATION, SOUTH KENSINGTON.

BY G. A. BAXANDALL,

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Stage 2.

Algebra.

Involution and Evolution.—Read C. Smith, Arts. 67 and 69; chap. xviii.; Arts. 273 to 276. Hall and Knight, chaps. xv. and xvi. H. Smith, chaps. iii., xvii., and xviii. Todhunter and Loney, Arts. 105 to 108, and 113; chap. xxviii.

These articles and chapters deal with the rules for squaring and cubing an expression containing *any* number of terms, and for determining the square root and cube root of any expression. The rules for writing down the expression for $(x + a)^3$, $(x + y + z)^2$, $(x + y)^3$, $(x - y + z)^3$, etc., are easily learned. Those for obtaining the square and cube roots are somewhat more difficult to apply; and as they are rarely used in other portions of the work, they are soon forgotten. For examination purposes, however, it is necessary to know them.

Select examples from the sets provided in the above articles and chapters. Also work the following:—

1. Without multiplying out the expressions, show—

(*a*) That $(a + b + c)^3 - (b + c - a)^3 - (c + a - b)^3 - (a + b - c)^3$ is some multiple (M) of $a\,b\,c$.

(*b*) That M = 24. (1900.)

2. Extract the square root of each of the following expressions:—

(*a*) $(3x^2 - 11x + 6)^2 + 12x(3x - 2)^2$.

(*b*) $x^{12} - 8x^9 + 18x^6 - 8x^3 + 1$.

(*c*) $x(x^3 - 64) + 8(x^3 + 8)$.

Ans. $(3x - 2)(x + 3)$; $x^6 - 4x^3 + 1$; $x^2 + 4x - 8$.

3. Express $2(x - y)(x - z) + 2(y - z)(y - x) + 2(z - x)(z - y)$ as the sum of three squares.

Ans. $(x - y)^2 + (x - z)^2 + (y - z)^2$.

4. Extract the cube root of

$$x^6 + 12x^5 - 320x^3 + 3072x - 4096.$$

Ans. $x^2 + 4x - 16$.

Trigonometry.

It is customary to learn the definitions of the sine, cosine, and tangent of an angle *first* when the angle is *acute*. It now becomes necessary to extend the definitions to the case of an angle of *any* magnitude. In considering such angles, we distinguish between lines which are measured in one direction from those which are measured in the opposite direction by employing the signs + and −.

Read Loney, Arts. 48 to 50; Hall and Knight, chap. viii.; Lock, chap. ix.; H. Smith, Arts. 62 to 64.

Work the following examples:—

1. A line AP, 12 units long, rotates from a position AE, so that the angle EAP has the values given below. Draw figures showing AP in each position, and by the aid of mathematical tables complete the following table, PN being a perpendicular from P on to AE, or EA produced.

Angle EAP.	Sine.	Cosine.	Tangent.	PN.	AN.
28°	·4695				
113°		−·3907			
194°			·2493		
298°				−5·6340	
388°					10·5948

2. In a triangle ABC, the base BC = 12·6, AB = 10·8, and B = 41°. Draw a perpendicular from A, meeting BC in D. Show that the lengths of AD, BD, and CD are 7·086, 8·151, and 4·449. Show that the area of the triangle (that is, ½AD × BC) is 44·64. Now divide AD by DC and obtain the tangent of C, and by means of the tables show that C is nearly 57° 53′, and that therefore A is 180° − 41° − 57° 53′, or 81° 7′. Finally, show that AC is 8·368.

3. In a triangle ABC, AB = 18·6, B = 62°, C = 50°. Draw AD perpendicular to BC. Show that AD and BD are 16·42 and 8·733. Seeing that AD divided by AC is sin 50°, show that AC is 21·44. Now show that DC is 13·78, and therefore BC = 22·51. In this way, having given two sides of a triangle and an angle opposite one of these sides, you may find the third angle and the other two sides.

4. Draw figures showing angles of 25°, 155°, 205°, 335°, 385°, 515°, and show that their sines are the same *numerically*, but that the first two and the last two are positive, while the rest are negative.

5. (*a*) Show how to construct an angle whose cosine is 0·6, and write down the numerical values of the sine and tangent of that angle.

(*b*) A is a positive angle less than two right angles. Express tan A in terms of sin A, and explain why there are two values which differ only in sign.

(*c*) Find the six positive values of θ less than 360° which satisfy the equation $2\cos 3\theta = \sqrt{3}$.

Ans. (*a*) ·8 and 1·3; (*b*) $\sin A \div \sqrt{1 - \sin^2 A}$; (*c*) 10°, 110°, 130°, 230°, 250°, 350°.

Geometry.

Read Props. 1 to 15, Book III.

Work the following exercises on the above propositions:—

1. Two circles whose centres are A and B intersect at C; through C two chords, DCE and FCG, are drawn, equally inclined to AB, and terminated by the circles. Show that DE and FG are equal.

2. O is the centre of a circle, P is any point in its circumference, PN a perpendicular on a fixed diameter. Show that the straight line which bisects the angle OPN always passes through one or the other of two fixed points.

Stage 3.

Algebra.

Permutations and Combinations.—Hall and Knight, chap. xi., more particularly the formulæ in Arts. 141, 142, 144, 146, 151, and 156. Read carefully over all the examples which are fully worked out.

Consider very carefully the portion in italics of Art. 140, and while studying the articles which follow, return to this one time after time, and try to realise that it is of fundamental importance.

Briggs and Bryan, *Intermediate Algebra*, chaps. xx. and xxi., more particularly the formulæ of Arts. 295, 297, 298, 305, 306, 310, 320. Read carefully through the examples which are worked out. Art. 288 is the most important one, and corresponds with Art. 140 referred to above. Todhunter and Loney, chap. xxxviii. C. Smith, *Treatise on Algebra*, chap. xix.

Select and work examples from the various sets to be found in each text-book.

Work the following:—

1. Find how many numbers there are of four digits, two of which are zeros. (1900.) Ans. 243.

2. Out of 40 consecutive integers, in how many ways can three be selected whose sum is even? (1899.) Ans. 4940.

3. If a, b, c, d, e, f are six different prime numbers, find in how many different ways the product a^2b^2cdef can be expressed as a product of two factors. (1900.) Ans. 95.

4. Find how many different numbers, of four figures each, can be formed when any of the six figures 1, 1, 2, 2, 3, 4 may be used. (1898.) Ans. 162.

Trigonometry.

Read Hall and Knight, Arts. 135, 136, 149; Loney, Arts. 127, 173. Work examples from the sets which come immediately after these articles.

The following examples are taken from the examination papers of May and June 1900:—

1. Find the positive values of θ less than two right angles which satisfy the equations—

(*a*) $\cos\theta = \cos 102° 45' - \sin 45° 45'$.

(*b*) $\sin\theta = \sqrt{(2 \tan 7° 30')}$.

Ans. (*a*) 159° 33′ 12·9″, 200° 26′ 47·1″; (*b*) 30° 52′ 21·8″, 149° 7′ 38·2″.

2. Find the positive values of θ, less than 360°, which satisfy the equations—

(*a*) $\cos\theta = \sin 29° 15' \tan 172° 30'$.

(*b*) $\cos\theta = \pm\sqrt{(\sin 66° 50')}$.

Ans. (*a*) 93° 41′ 17·8″, 266° 18′ 42·2″; (*b*) 16° 29′ 49·4″, 163° 30′ 10·6″, 196° 29′ 49·4″, 343° 30′ 10·6″.

To a student who knows how to use a book of mathematical tables, all such examples as these are exceedingly easy and straightforward. If he has the slightest trouble with them, it is a sure sign that he needs more practice in the use of tables, and in taking out the sine, cosine, and tangent of angles greater than 90°. We have attached the answers, which the student is supposed to obtain by using 7-figured tables such as Chambers's.

3. In any triangle ABC prove that—

(1) $a^3 \cos(B - C) + b^3 \cos(C - A) + c^3 \cos(A - B) = 3abc$.

(2) $\cos A + \cos B = \dfrac{a+b}{c} 2 \sin^2 \dfrac{C}{2}$.

(3) $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$.

4. Two vertical poles, whose heights are a and b, subtend the same angle α at a point in the line joining their feet. If they subtend angles β and γ at any point in the horizontal plane at which the line joining their feet subtends a right angle, prove that $(a+b)^2 \cot^2\alpha = a^2 \cot^2\beta + b^2 \cot^2\gamma$.

Geometry.

Work the following exercises on Props. 1 to 6, Book VI.:—

1. ABC is a triangle. From a point P in AB, or AB produced, draw a straight line to AC, or AC produced, so that it may be bisected by BC.

2. AB is a straight line, and D any point in it. Determine a point P in AB produced, such that PA is to PB as DA is to DB.

3. In the sides AB, AC of a triangle ABC are taken points, D, E, such that BD is equal to CE. DE, BC are produced to meet at F. Show that AB is to AC as EF is to DF.

NOTES ON THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, Geometry, etc., Morley College, London; Author of "Elementary Practical Physics," etc.

ADVANCED AND HONOURS STAGES.

In the preceding "Notes" we have found that when a force of constant magnitude, which we may denote by F, acts on a body, and the body is displaced through a distance S in the direction of the force, the work done is denoted by FS; but there are many cases in which the displacement of the body is not in the line of action of the force. Thus, to take a simple illustration, a tram-car would, of course, move in the direction determined by the rails, but the horses pulling the car may be pulling at an angle (which may be denoted by θ) to the direction of the rails. In such a case the work done would not be the product of P and the displacement of the car; but instead of P the force required is its revolved part in the direction of the rails, and the work done is PS cos θ.

Again, the work done by a force may be either positive or negative—the former when the displacement is in the same direction as the force, and the latter when in the opposite direction.

The *unit of work*, which is simply *unit force multiplied by unit distance*, has not received any short name, except when, as in C.G.S. units, forces are expressed in dynes and distances in centimetres. The unit of work is then a force of one dyne multiplied by a distance of one centimetre, and this dyne-centimetre is called an ERG. When forces are measured in pounds and distances in feet, the work done is estimated in foot-pounds.

When the force is constant, the diagram of work may be usefully represented by a rectangle, in which one side to some convenient scale denotes the magnitude of the force, and the other the displacement. The diagram of work is then represented by the area of the rectangle.

But the diagram of work may also be drawn when the force is variable. In such a case, if to any convenient scale along a horizontal line distances are taken denoting displacements, and vertical lines denoting the magnitude of the force for the various displacements, then a series of points is obtained. These may be joined by a curve, and the area of the figure bounded by the curved line, the base, and the extreme vertical lines will represent the work done. As a simple example, we may consider the force or pressure exerted by the gas on the piston in the cylinder of an engine, if the assumption is made that *Boyle's Law* holds—namely, that for *a given quantity of gas the force exerted varies inversely as the volume when the temperature remains constant* (an assumption which may be made for air, but which is only approximately true for steam gas). Then if horizontal distances (or *abscissæ*) represent the volumes assumed by the gas, and vertical lines (or *ordinates*) the corresponding pressures, the ordinates so drawn trace out by their extremities a curve called a *rectangular hyperbola*. This is easily drawn, from the fact that if P and V denote the pressure and volume of the gas at any point of the curve, and P_1V_1 the pressure and volume at any other point, then the relation is $PV = P_1V_1$, from which, when any three of the four terms are given, the remaining term can be found. Thus, let P = 60 lbs. per square inch, V = 2 cubic feet; then, if the volume change to 3 cubic feet, denoting the new pressure by P_1, we have—

$$P_1 = \frac{60 \times 2}{3} = 40 \text{ lbs. per square inch.}$$

In this manner, when the volume is 4, 5, 6, etc., the corresponding pressures may be obtained, and the curve drawn. The area of the curve between the lines denoting the initial and final volumes is the work done. The estimation of such an area may be obtained in many different ways. The distance between the lines denoting the initial and final volumes may be divided into a number of equal parts, and the mean ordinate obtained. The product of the mean ordinate and the distance between the two lines referred to will give the area of the curve, or the area may be obtained by an application of Simpson's Rule, by a planimeter, or by integration. If the ratio of the final volume to the initial volume be denoted by r, then the area is given by $PV \log_e r$.

Ex. 1. The quantity of air which occupies a volume of 50 cubic feet under a pressure of 15 lbs. per square inch is allowed to expand at a constant temperature to 60 cubic feet. Find the number of foot-pounds of work done. (Hyp. log 1·2 = 0·1823216.) (1892.)

Here P = 15, V = 50, V_1 = 60.

To obtain the result in foot-pounds it is necessary to express P in pounds per square foot.

Thus P = 15 × 144 lbs. per square foot.

$\therefore$ work done = $15 \times 144 \times 50 \log_e r$;

but $r = \dfrac{60}{50} = 1{\cdot}2$,

hyp. log 1·2 = ·1823216.

$\therefore$ work done = $15 \times 144 \times 50 \times {\cdot}1823216$

= 19690·7 foot-pounds.

Ex. 2. Show how to find the work done by a variable force, and show the merit of graphical construction by taking as an example the work done on the piston in a steam engine.

A heavy hemisphere rests upon a horizontal plane, with its base horizontal and uppermost. How much work must be performed in turning it over on to its base? (1899.)

(The centre of gravity of a hemisphere is at a distance of $\frac{3}{8}$ths the radius from the centre.)

In this question, unless the student is careful, he is liable to fall into error. Thus, the centre of gravity of the hemisphere, when resting with its base uppermost, is at a distance $\frac{3}{8}r$ from the plane on which it rests (where r is the radius).

When turned over on to its base, the distance of the centre of gravity from the same plane is $\frac{1}{2}r$. Hence it would appear that the centre of gravity has changed from $\frac{3}{8}r$ to $\frac{1}{2}r$ or $\frac{1}{8}r$—that is, the potential energy has been *diminished* by $\frac{1}{8}r$W, where W denotes the weight of the hemisphere; but this does not represent the work done in turning the hemisphere over. To do this, it will be obvious that the centre of gravity of the hemisphere must be made to pass vertically over the point where the rim of the hemisphere touches the plane. Hence the distance (the radius being divided into eight parts) is

$$\sqrt{8^2 + 3^2} = \sqrt{73}.$$

And the work done is therefore—

$$= \left(\frac{\sqrt{73} - 5}{8}\right) \mathrm{W}r.$$

Ex. 3. When a given quantity of gas expands at a constant temperature, show how to represent graphically the work done, and justify the construction by reference to first principles. (1899.)

Ex. 4. Describe and explain the behaviour of bubbles rising in a bottle of soda water.

At what depth in the ocean will the pressure of air in a bubble be double that of the atmosphere? Taking the height of the atmosphere to be 8,000 metres, find the depth at which bubbles will be in equilibrium. (1900.)

Ex. 5. If a distance, AB, be divided into two equal parts at C, and the magnitudes of the forces at A, B, C are P, Q, R respectively, show that the work is—

$$AB(P + 4R + Q) \div 6 \text{ units},$$

and state on what suppositions, as to the variation of the force, this formula can be trusted to give a nearly correct answer. (1900.)

Ex. 6. If 1,000 cubic inches of air, under a pressure of 20 lbs. per square inch, are mixed with 800 cubic inches of air under a pressure of 15 lbs. per square inch, supposing the temperatures the same, find the pressure of the mixture if it has a volume of 1,500 cubic inches. Ans. $21\frac{1}{3}$ lbs. per square inch.

Ex. 7. A curve is drawn, and AN, NP are the abscissa and ordinate of any point P on the curve. If AN represents the distance through which a force has acted, and PN represents the magnitude of the force when it has acted through that distance, show that the area of the curve represents the work done by the force. (1896.)

Ex. 8. Find, from first principles, an expression for the work done when a given quantity of air undergoes a change of volume without change of temperature.

A given quantity of air occupies a volume of 15 cubic feet under a pressure of 20 lbs. per square inch. How many foot-pounds of work are required to compress it to 5 cubic feet if the temperature remains constant? (Log 3 = 1·0986.) (1896.)

Ex. 9. If the volume of a certain quantity of gas is 10 cubic feet, and the pressure 20 lbs. per square inch, find how many foot-pounds of work will be done when it expands at a constant temperature. (1898.)

Ex. 10. If a curve be drawn in such a way that the ordinates represent the successive values of a variable force, and the corresponding abscissæ the distances through which it acts, show that the area represents the work done by the force. (1892.)

Ex. 11. A given quantity of gas has a volume V, under a pressure P, at a given temperature. If its volume becomes v without change of temperature, show that the work done by the gas during expansion is $PV \log_e \frac{v}{V}$. (1894.)

Ex. 12. O, A, B are three points in order along a line Ox; AH is drawn at right angles to Ox; P is a force acting in the direction O to x, and its point of application moves in the direction O to x. The magnitude of P varies inversely as the distance of its point of application from O. Given that its magnitude at A is represented by AH, show how to draw a diagram of the work done while the point of application moves from A to B. If OA = 1 foot, OB = 9 feet, AH = 12 lbs., draw the diagram of work, and find the number of foot-pounds of work done by the force. (1894.)

Ans. 26·37 foot-pounds.

SCIENCE NOTES.

Hybrids and their Pollen.—Jencie has recently conducted an interesting series of experiments on the relative fertility of hybrids, and especially their capacity for producing fertile pollen. He examined thirty-three living and ten dried species. In all of them there was found a decreased fertility, but the degree of reduction varied greatly. In some cases no pollen was produced. In the *Orchidiæ* there was but a slight reduction. Between these extremes all intermediate grades were found to occur. In all cases hybrids between nearly related species were found to be more fertile than those between species less clearly related.

A New Parasitic Fungus.—A new parasitic fungus has been discovered by Lucet and Constantin. They found in the bronchial tubes of a woman, about thirty years of age, living in the country, a fungus belonging to the *Mucorini*. They have given it the name of *Rhizomucor parasiticus*. It is parasitic and pathogenous, causing cough. It is pathogenous to rabbits and guinea pigs, but not to dogs. The new fungus constitutes a new section of the genus *Rhizomucor*, characterised by irregular stolons and rhizoids and branched sporangiophores. The columel is surrounded by the *débris* of the membrane of the sporange.

Plants and Inulin.—Parkin, in a recent number of the *Annals of Botany*, considers the most abundant carbo-hydrate in the bulb-scales of the hyacinth to be an inulin—that is, it is lævorotatory, and is converted by hydrolysis into fructose. He is of opinion that three kinds of inulin exist in plants—that found in *Compositæ* and the allied orders; that in *Hyacinthus, Scilla, Yucca*, and *Phleum*; and that found in *Galanthus* and *Leucojum*.

The Structure of Galls.—Küster has lately given a good summary of the structure of galls. Those galls arising from the superficial growth of the part of the plant attacked are always of simple structure. A great histological differentiation is found only in those which are the result of growth in thickness. The epiderm is the tissue which offers the longest resistance to the action of the gall irritant. The foci of formation of the gall are the mesophyll, the cortex, and the pith. The most important change which the epiderm undergoes is the formation of hairs. In the fully developed gall itself the epidermal tissue is greatly developed, the cork and bark but feebly. The stomates are often developed in galls as air-fissures, which remain permanently open. In some willow-galls true lenticels are formed. The assimilating tissue is usually but feebly developed. Mechanical tissues are almost invariably present in those galls which are produced by growth in thickness. There are no stereids. The cells of the galls themselves may resemble in form and arrangement those of the normal parts of the plant affected, or the arrangement may be altered, or forms of cells or of tissues may arise which are not present in the normal part of the plant. The gall-irritant is a compound of various sources of irritation.

The Function of Raphides.—The popular theory that the presence of raphides (crystals of calcium oxalate) in the tissues of plants serves to protect them against the attacks of animals is now attacked by L. Leuin. He points out that it is contradicted by the fact that some of these plants are edible by man, while many are eagerly devoured by animals of all kinds. The mechanical injury to the digestive organs of animals which has been attributed to them is also not supported by facts. There is no evidence that raphides are injurious when they are present in plants not otherwise poisonous. It seems highly probable that they act as carriers of the poisonous substances characteristic of the species, and they may therefore have indirectly a powerful toxic effect.

A New Species of Evening Primrose.—M. de Vries has given the name of *Œnothera gigas* to a new species of evening primrose. In a culture of *Œnothera lamarckiana* a single individual occurred which differed in several distinct points of structure from the parent form, and presented all the characters of a distinct species. These specific characters were repeated for three generations without exhibiting any tendency to return to the parent form.

Mummy Wheat and Barley.—The often seen statement that mummy wheat and barley can germinate after thousands of years appears to be disposed of by M. Gain. He has examined the structure of the embryo of grains of wheat and barley that have been obtained from Egyptian mummy cases, and he finds that although the grains have undergone but little change in external appearance, and the reserve substances have retained their chemical composition, the chemical composition of the embryo has been completely altered, and it is no longer capable of development. The dormant life of the seed must have long ago expired.

Starch-Corroding Fungi.—F. H. Billings regards *Amylotrogus* as a true fungus rather than as a reduced *Myxomycete*. He describes five species which have the property of corroding starch, the corrosion being effected by true hyphæ, and not by a plasmode. Other starch-corroding fungi are *Styxanus stemonitis*, and species of *Trichocladium, Chætomium, Fusarium, Coremium*.

The Distribution of Carotin in Plants.—Tammes has examined a great number of different plants with reference to the distribution of carotin in plants. He concludes that the pigment of green and etiolated leaves, and of those which turn green in the autumn, of fruits and seeds, and of green, blue-green, brown, and red algæ, agrees in all its chemical and physical properties with the carotin of the carrot. He states also that in all plants, or parts of plants which contain chlorophyll, and which are capable of carbon dioxide assimilation, carotin is invariably associated with chlorophyll, and that it can even induce assimilation by itself.

The Formation of Oxalic Acid by Bacteria.—Zopf has found by experiment that a number of acetic bacteria have the property of converting racemic into oxalic acid. They are *Bacterium aceti, B. acetigenum, B. acetosum, B. ascendens, B. Kützingianum, B. pasteurianum, B. xylinum*. Minute crystals of calcium oxalate were always found when these bacteria were cultivated on a nutrient substratum consisting of ten per cent. gelatin, two to three per cent. grape sugar, one per cent. peptone, and one per cent. extract of meat. Control experiments, in which the grape sugar was omitted from the nutritive medium, gave negative results.

OUR COMPETITION PAGE

OUR FRENCH PRIZE COMPETITION.

Prize Editor—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

Important to Scholarship, Certificate, and London Matriculation Students.

WE should like to specially direct the attention of our readers to the fact that the Board of Education, in the Syllabuses for the Scholarship and Certificate Examinations 1901, requires "no set books" for French and German. Students preparing for these examinations, as well as students for London Matriculation, could not do better than attempt month by month the pieces set for translation here. They are from the best authors, and of varied character. A competitor who does not gain a prize can derive considerable benefit from the exercise. A study of the successful competitor's translation, and of our remarks, will help him to see where he might have done better. If desired, his paper can be returned (fully corrected) by enclosing six stamps together with a stamped and addressed envelope.—ED.

RULES.

1. All translations should be **posted not later than January 8**, and addressed :—*Prize Editor*, Office of THE PRACTICAL TEACHER, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.
4. No competitor may take the prize offered more than once in three months.

FRENCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract :—

LA MORT DE MON PÈRE.

Me souvenir?—J'ai l'impression d'avoir, durant des années, gravi un Calvaire de douleur! Mais quel fut mon premier pas sur ce chemin tout mouillé de taches de sang? Par où prendre cette histoire du lent martyre dont je subis aujourd'hui les affres dernières? Je ne sais plus.—Les sentiments ressemblent à ces plages mangées de lagunes qui ne laissent pas deviner où commence, où finit la mer, vague pays, sables noyés d'eau, ligne incertaine et changeante d'une côte sans cesse reformée et déformée. Cela n'a pas de bornes et pas de contours. On dessine pourtant ces contrées sur la carte, et nos sentiments aussi, nous les dessinons après coup, par la réflexion et avec de l'analyse. Mais la réalité, qu'elle est flottante et mouvante! Comme elle échappe à l'étreinte! Enigme des énigmes que la minute exacte où une plaie s'ouvre dans le cœur—une de ces plaies qui ne se sont pas refermées dans le mien.—Afin de tout simplifier et de ne pas sombrer dans cette douloureuse torpeur de la rêverie qui m'envahit comme un opium, attaquons cette histoire par les événements. Marquons du moins le fait précis qui fut la cause première et déterminante de tout le reste: cette mort de mon père, si tragique et si mystérieuse. Essayons de retrouver la sorte d'émotion qui me terrassa dès lors, sans y rien mêler de ce que j'ai compris et senti depuis. PAUL BOURGET.

RESULT OF THE DECEMBER COMPETITION.

French.

The prize is awarded to "Agaznog," the pseudonym of Miss Annie Keating, St. John's Priory, Banbury, Oxon.

First Class.—A plain woman, Burnham, Rioghail, Polly, C.E.M., Chemineau, Little Dorrit, Nez fin, Bothered, Rustica, The Wyvern, L'oncle, N'importe, J.P., Esmond, Maida Vale, Kettering, Oakover, Normalienne, Myosotis, Kerboga, Beetle, Mary, Tibi, F.J.C., Sans souci, Dragon, N.A.F., Rouennaise, N.H.O.P., Ascanius, Airlie, Lucy Snowe, Gaelic, Roby, Marguerite, Noel, Leilani, Patience, Integer, Piocheur, Despair, An attempt, Didymus, Rossignol, H.C.S., La plume, E.S.G., Rani Rucki, Moss rose, Rats, Dalrymple, Forward, Diana, Molly, Veilchen, P.T., Joy, Manu forti, Bouloir, Eothen, W.J.L., Charlotte Corday, Kythé, Undergrad, Anwyl Gariad, Bonnie Dundee, Nelvil, Kitaitz, Bonne chance, The prodigal parson, Molly Bawn, Hélène, Liverpool, Nancy, Nil desperandum, Les cloches de Corneville, Vincit, Mariquita, Stay at home, G.B.N., Mollie M'Farlane, Penweeth, Carpe diem, Llanroc, M.E.E., Uranie, W.H.O., Hurried, P.T.A.M., Periwinkle, Immaculata, En avant, Vélocipède, Castle Eden.

Second Class.—Asthore, Alpha, Irénée, I.C.E., Ethelwulf, Andromache, Sah-luma, Mardun, Perseverance, Sculpin, A.M.D.G., Ballin Tubber, Rooinek, Acanthus, Le sucre, Cordelia, Stella, Tolpan, G.E.P., Penybont-ar-Ogwy, Dorothy Vernon, Hong-Kong, Farmstead.

Sent up last month's paper: K.H. "Hungary" received too late for classification.

Report.

The chief difficulty in the translation was to find a pair of English words expressing the difference between *fâcheux* and *raseur*. Candidates have displayed very great ingenuity in trying to find out words which would exactly express the distinction, and have pretty well exhausted the resources of the English language in their attempts to do so. I have accepted everything which was at all suitable, but have had to reject such words as "toady," "humbug," "prig," "irascible," etc., which do not convey the idea of either of the French words mentioned. Many candidates have wisely given up the attempt to find an English equivalent of *raseur*. The successful candidate has produced a very spirited translation, but the expression, "duller sort," is open to an obvious misconception. In answer to queries, we beg again to say that candidates are arranged in order of merit.

French Prize Translation.

Our current speech discriminates between bores and bores. Strictly speaking, there is a subtle difference in the two varieties. Nature is responsible for what may be deemed the more acute form; accident is often the parent of the duller sort. One may possess undeniable wit and tact, but if one drops in unawares on a domestic quarrel, if one disturbs an amatory *tête-à-tête*, if one times a visit just as the person visited had arranged to go out, one is infallibly, it goes without saying, voted a bore; but this is a mere accidental result. However, it may be added that rapid perception will instantly reveal his fault to the offender, and tact will teach him to retire without betraying that he has noted the embarrassment his presence caused. The man driven by his evil star to be an accidental bore remains such only by preoccupation with himself, or unless the fatal gift is nature's dower to him. Your true bore is born, not made. This is shown not alone in the great delight he takes in speaking of himself, his trifling interests, his health, his wife, his servants, or in his obtruding these *minutiæ* on all he meets, but much more in that, having his own ideas of politics, religion, philosophy, the price of corn, the running of omnibuses—and these ideas he shares with the man in the street—he discusses them with unshaken conviction and solemn seriousness. He enters into each minute detail, and it is only when you leave him your button in his fingers that he relaxes his grip of your waistcoat. AGAZNOG.

THE EDITOR'S TABLE

MODERN LANGUAGE TEACHING.

II.* J. M. DENT AND CO.

Dent's Modern Language Series. Edited by Walter Rippmann, M.A.

Outlines of French Historical Grammar. By Alfred T. Baker, M.A. This manual gives a philological sketch of the development of the French language. It will prove useful to those who are preparing for the higher university examinations, and a handy reference book for the student of old French literature. The first forty-eight pages are devoted to the history of the language. Then follows a treatise on the *sounds* of the language, traced from their earlier forms; and lastly, the *words*, both separately and in relation to the sentence, are subjected to the same severe philological process. By means of the three sections, therefore, we can follow the gradual change from the synthetic Latin to the analytic French. An appendix gives the French and German authorities consulted by the author, and there is also a most interesting collection of literary specimens, from the rimed prose of Frodebert, the Strassburg Oaths, and the *cantilène* of the *buona pulcella Eulalia* down to the *joyeux curé de Meudon* and d'Aubigné, the faithful servant of Henri of Navarre. The alphabet of the Association Phonétique Internationale is employed throughout to indicate the pronunciation. We recommend this grammar to university students, and to all who are interested either in old French literature or in the thorough-going scientific methods of modern philology.

First French Book. By S. Alge and W. Rippmann. We feel interested at once, for the name of Alge the reformer upon an English school book means that England is really moving at last in the matter of reformed language teaching. The book is an English adaptation of Alge's manual, which has proved so great a success in Switzerland. It is intended to be used in connection with the Hölzel pictures, small reproductions of which appear at the end of the volume. The only English we have been able to find in the book is Mr. Rippmann's preface, in which he very rudely turns his back upon the critic—a most perfunctory sort of person according to him—and addresses his little friends, known and unknown. The critic will have nothing but good to say of this work, for the *Méthode Intuitive* is by no means new to him; but what a shock it will be to the old-fashioned teacher! "Not a word of English anywhere; no translation; no French-English, English-French exercises; the grammar relegated to the latter pages, and even there written in French; a phonetic section in which signs barbarous and uncouth are to be used to facilitate the acquirement of a good French pronunciation! Why invent new symbols? French can be, and *is*, taught without pronunciation in England." We can imagine the teacher who has remained in the old groove, utterly at a loss how to make use of this book in class. To meet this case, Mr. Rippmann, as a thoughtful innovator, publishes a companion book, *Hints on Teaching French*, which will prove a valuable aid to the teacher who wishes to be up to date. The principles advocated are those to which we have continually alluded in these pages—principles which do not gain in this country the rapid and widespread recognition which they merit. The acquirement of a language as a direct instrument of thought, the use of pictures, the importance of pronunciation, and the system of international phonetics, are here discussed. We can assure the teacher who is scared by the odd appearance of the new symbols that they are not so dreadful as they seem. In a quarter of an hour they can be mastered quite easily, and a French phonetic text can be read which a few moments before appeared repulsively unintelligible. As a means of teaching foreign pronunciation, the new letters are undoubtedly valuable. The remainder of the "Hints" is a running commentary on the contents of the First and Second French Books.

The Second French Book—entirely in French. The first twenty-eight pages are devoted to interesting readings and elliptical exercises, framed to illustrate the use of the tenses. The sequences are well taught—for example, *Si j'étais fatigué, je me reposerais*. The story of Pierre Delsart and his adventurous journey to Paris forms the basis for questions, ellipses, word meanings, and grammatical notes—all given in French.

Une Joyeuse Nichée (A Merry Houseful). A simple tale of child life by Mme. de Pressensé. As before, the feature to be noted is that the French text forms the material for practice in French, and *not* for translation. Easy composition is introduced, and there is a list of irregular verbs.

La Vieille Cousine.
La Loterie de Francfort.
Le Testament de Madame Patural.

These three little plays by Souvestre are intended as reading matter for the third year. We are glad to observe that the annotator acknowledges our old favourite, the dictionary of Larousse, as a great help in framing the explanations which are given in French. The arrangement is novel, the text being placed in the upper half of the page, with the notes beneath. This plan, of course, arises from the admirable system of giving all annotations in the language of the text.

The German course corresponding to the above consists of *The First German Book* (compare *Leitfaden für den ersten Unterricht im Deutschen*, S. Alge, 1897), *The German Reader*, and *Hints on the Teaching of German*. The first is printed in Roman characters, and is to be used in connection with the Hölzel pictures; the second is beautifully printed in German type. This course being arranged upon the same plan as the French course, it is unnecessary to notice the volumes in detail. The whole series form an admirable example of the direct method, and we advise earnest teachers to examine them, simply in order to contrast them with the dry-as-dust exercises of the old method. Even if we had lighted upon small defects, we should have felt that petty criticism is here quite out of place. We urge English teachers to study, as deeply as their opportunities will allow, the whole wide question of the reform of language teaching. In this series they will find frequent allusion to much that has been written upon the subject. In addition, we refer them to the report by J. Hubscher, *De l'enseignement des Langues Vivantes*, Imprimerie Victor Fatio, Lausanne. This is valuable to the busy teacher, as giving a brief and concise explanation of the various reformed methods, with references to the chief manuals.

Dr. Kron's "French Daily Life;" Dr. Kron's "German Daily Life." (Dent and Co.) **The Facts of Life** (*die Thatsachen des Lebens*). (George Philip and Son.) When a student is unable to reside where the language under study is commonly spoken, he sooner or later comes face to face with a great practical difficulty—namely, that of gaining readiness in discussing the topics of everyday life. His circumstances force him to depend upon direct reading of foreign literature—reading aloud—as a substitute for constant practice in conversation. The result is that he acquires an immense, unwieldy, somewhat archaic vocabulary. On arriving upon a foreign shore, he is often unduly dismayed and depressed at his helplessness and awkwardness in commonplace talk. Yet such unreadiness is only to be expected, for in speech the great thing is habit. We have grouped these three manuals because they have the one purpose of supplying the chief need of the foreigner—a ready stock of words and phrases by means of which he can order his meals, make necessary inquiries, and pay visits without posing as a deaf-mute.

We all know the ancient means to this end—the phrase-book, the tourist's companion, etc.; and some of us know the dull, dreary drudgery of wading through them. Still, it was better to endure the narcotic tedium of imaginary confabulations with "the butcher, the baker, the candlestick-maker," than to wander about in France or Germany "silent as a mummy." The two books of Dent's series—*French and German Daily Life*—meet the case by giving you what you need in the form of interesting readers. They could therefore be used with advantage in advanced conversational classes. The book by Messrs. Bétis and Swan—*The Facts of Life*—supplies the same need by a different process—by the logical sequences of the Gouin method. When

* ***Next Month: "III. Modern Languages and Modern Phonetics."***

we first observed the Gouin system some years ago, we were amazed to note the wonderful aid afforded to the memory by the methodical succession of sentences, describing common actions in the order in which they are usually performed. Few realise what a gigantic task the acquiring of a full foreign vocabulary is, for an ordinary brain. Any device that will assist the memory should be eagerly welcomed; for, without increasing his vocabulary, the student can derive neither pleasure nor profit from the use of the foreign tongue.

Finally, the thought that persistently intrudes itself upon us as we review the new methods is this: *our language examinations must be abolished or reformed.* If the teachers advance, and the examiners remain in the old groove, we shall be working at cross-purposes. The reformers rightly advocate minute study of foreign pronunciation, phonetic symbols, and physiological knowledge of the organs of speech. Our examiners in many cases utterly ignore the spoken language. The reformers reserve the systematic study of grammar and translation for advanced pupils. The examiners demand these from beginners; in fact, for examination purposes, grammar and translation form the be-all and the end-all.

ADAM AND CHARLES BLACK.

Grammaire Française. An elementary French grammar, written entirely in French, for the use of English pupils. This is a novelty which implies a great deal. Children cannot possibly use this book in the initial stages, for they must first acquire some command of French in order to read and discuss grammar in the foreign tongue. Hence it will have to be inductive grammar; they will form their generalisations from practical knowledge of numerous instances. The teacher will commence with oral practice in French; he will fix to the wall of his classroom the stern prohibition, *Défense de parler anglais.* Then, "at the psychological moment," he will introduce grammar, culled from the pupils' reading and conversation. We are quite in sympathy with the author of this little book. We have repeatedly maintained that a pupil's knowledge of grammar should grow gradually from observant reading and oral practice, much as a knowledge of chemistry is acquired by constant observation and innumerable experiments. He will learn grammar rapidly when he sees in it the summing up of what he has already observed. Moreover, he feels himself something of a discoverer when, under the guidance of the teacher, he has gathered from familiar examples a grammatical rule all for himself. This little work ought to be a success.

BLACKIE AND SON.

French Commercial Correspondence by Easy Stages. By A. Starck. This is a combination of the rudiments of French grammar and the usual terms of French commercial correspondence, and is intended for use in our commercial schools and continuation classes. In the preface, the teacher is told that he must read all the French words to the students, because the French spelling is often misleading. Surely teachers of commercial French are not in such a bad way as this naïve hint would imply. The upper parts of the pages form an elementary grammar of the ordinary kind, with exercises below. At the end there are a set of examination papers, and vocabularies of commercial and technical words. The author's idea seems to be that of teaching composition by the gradual amplification of the detached sentences which form the exercises. But will the student find them sufficiently interesting? We cannot get up the feeblest interest in remarks such as: "Let us be sincere. We have known several manufacturers who were sincere." On another page we are told that "the father of the gentleman would have been more furious," and that "the tradesman was more furious than pleased." Again, the book says: "I have the tallow; thou hast the ox; they have bought the zinc; and we have the corn." But what is ultimately done with the tallow, the zinc, the ox, and the corn, is not stated. This incoherent style is continued through a long series of exercises. Only at the end do we find one or two letters in connected French. We do not recommend this work to teachers who find it necessary or expedient to infuse lively human interest into their French lessons. For a class where both teacher and students are possessed with the sole idea of grinding for a written examination in commercial French the book will serve a practical purpose.

H. A. BURLEIGH, BRISTOL.

Cunuder's French Eclectic Oral Method. This book at once impresses one favourably, both by the immense variety and the sound quality of most of its contents. In fact, the defects we have observed appear to have arisen from the endeavour of the author to crowd so much good suggestive material into one volume of about three hundred pages. The language teacher who has studied the various methods will soon perceive that the work fully merits its title of "eclectic," for it is a veritable *potpourri*, and for that very reason deserves attention. If we turn to the preface—which, by the way, is too florid to be very clear—we find minute study of intricate rules and translation of disconnected sentences condemned; which is as it should be. Yet at the end we read grammatical rules galore, without an example to elucidate them—pure dry abstractions which recall the worst defects of the old methods. The pronunciation rules are not helpful, and are arranged upon the old-fashioned plan of given approximate English equivalents for French sounds. The importance which M. Cunuder attaches to systematic training in expression; to the use of concrete, objective language first, and the abstract and figurative afterwards; to the employment of gesture and the simultaneous naming and performing of actions—all reminds one of the direct method. Yet grammar is introduced into the first lesson. The systematic use of objects and pictures does not appear to be intended, but would be advantageous. We are repeatedly reminded, too, of the Gouin method. The author speaks of "mental visualisation;" his lessons are coherent descriptions, object lessons, word-pictures; he follows the excellent plan of aiding verbal memory by connected anecdote and logical sequence. The third lesson, for instance, portrays a little four-year-old boy, with blue eyes, fair curls, and smiling face; another depicts the dwelling of primitive man; a third calls up the mental vision of a beautiful spring morning. These two hundred graduated lessons are a commendable piece of work. The study of a foreign language is a many-sided subject, and the author has striven to include something of everything. Each lesson is followed by grammatical questions relating to it, with references to the rules. Composition receives attention in the form of essays to be developed first *viva voce*, and afterwards in writing. The requirements of daily life are met in the conversations; and the author recommends that after about forty lessons French be made the speech of the classroom, the students being sometimes asked to question one another, or to assume rôles when the lesson is in dialogue form. There is a long list of errata; and we have ourselves noted further misprints. This is unfortunate in so useful a work. We hope, however, that it will speedily attain a second and revised edition. Teachers will find it a mine of valuable suggestions in their triple task of enabling students to understand, speak, and write the French language.

MACMILLAN AND CO.

French Course. First Year. By A. C. Poiré. A useful, practical little book for County Council elementary classes. The thirty lessons are composed upon the Gouin plan, and are very simple and clear. Thus, the first lesson commences: *How I pass the day.—I get up. I dress. I breakfast. I go out.* The author describes his work as a combination of the oral method and the book method, by which he enables the student (1) to learn the language usefully, and (2) satisfy the examiner. Is this a sly thrust at the examiner? The sentences are to be practised, first orally, and afterwards with the aid of the book. Indeed, the plan of the writer may be said to be: Train the ear, eye, hand, and brain. Begin with oral practice, proceed to reading and writing, and end with grammar. The grammatical rules are given collaterally in both English and French; and the best point we have noticed is the abundance of well-collocated examples—for instance, the treatment of the relative pronoun on page 65. The lists of adverbs, prepositions, conjunctions, and interjections, with the illustrative sentences, will prove very helpful. The volume also includes the usual conjugations, remarks upon the use of the tenses, classroom conversations, model words for drill in pronunciation, and very sensible hints for students. It is an eclectic manual, and will appeal to the practical teacher who knows by experience that it becomes monotonous to keep hammering away at any one "method."

JOHN MURRAY.

The Technical School French Grammar. By Dr. Krisch. The design of the author is to supply students with material for the grammatical study of French during a session of twenty-five lessons; and, as a work specially prepared for technical institutes, this grammar should have a useful career. The excessive minuteness of the accidence, involving the introduction of rare words like *serval*, *nopal*, *cantal*, strikes us as antiquated in these days of "reform movements;" while the inevitable plurals of *garlic*, and out-of-the-way facts—for example, *sous* =

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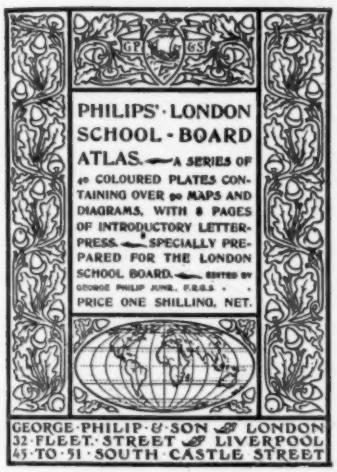
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pigsty; *le gai* (obsolete and Provençal) = the lively one; *le gaie* (Provençal) = motley—might well be left for future stages; they are obviously unsuitable for beginners with practical, technical aims. The conjunction *si* with the subjunctive (compare p. 62) will probably mislead beginners, whereas the common construction of *si* with the indicative would be of immense practical use. We will not venture to predict, as the author does, "that this book will enable any student to make quicker, surer progress than by any other method;" but the work has undoubtedly many good points. It gives the verb due prominence, and the synopses of terminations are good; it is based upon the construction of the simple sentence; the vocabulary and readings are of the right kind for technical students, and will supply ample material for conversation.

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The Law Relating to Schools and Teachers. By T. A. Organ, B.A., Barrister-at-Law of the Inner Temple and Oxford Circuit. It is to-day more necessary than ever that a knowledge of law should not be exclusively confined to those who attend the banqueting halls of the Inns of Court and satisfy the examiners of the Incorporated Law Society. Very few of us can pursue our vocation from day to day without an elementary knowledge of law.

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The author has made the very best of his unique opportunities, and has produced a book which we venture to predict will at once take its place amongst the standard works of legal literature. As standing counsel for the National Union of Teachers, Mr. Organ has had the run of material which could not have been at the disposal of any other barrister. Moreover, he brings to bear upon the subject the knowledge of an expert teacher. It is possibly this latter training which has enabled him to give such lucid expositions of legal mysteries.

Whether we consider this book from the standpoint of its logical arrangement, its concise and all-sufficient explanations, or its practical application, we have nothing but praise for it. There has long been a need for a book of this kind. How well Mr. Organ has met the demand, every person interested in education who takes up this work will speedily discover. There are sixteen chapters, not one of which is superfluous. Commencing with the central authorities, the author clearly sets out the jurisdiction of each, and next proceeds to give the law affecting the formation and constitution of School Boards. This occupies four chapters, one of which is especially useful, as it sets forth the powers of School Boards in delegating duties to managers. The use of schoolrooms for non-educational purposes has always been a subject bristling with legal difficulties. Mr. Organ gives us eight pages of valuable information on this topic. Chapter viii. will prove a *vade mecum* to the County Council and other officials who have to administer the Technical Instruction Acts.

Wales, with its state-constituted secondary education system, has one chapter all to itself.

The law relating to Industrial Schools occupies twenty pages, in which the powers of local authorities are very clearly set forth. Next we come to chapter xi., which deals with Reformatory Schools, and explains wherein these differ from and are similar to Industrial Schools. No book on school law would be complete without a chapter upon the eternal religious question. It will be very useful to the extremists to learn to what extent their ardour must be tempered by legal restraints.

The last four chapters are especially valuable to the practical teacher. As far as is possible, the almost hopeless chaos caused by the overlapping statutes on school attendance has been reduced to order. There is a very helpful chart included in this chapter. Teachers' superannuation and tenure of office next come in for treatment. The last chapter, on school punishment, is in itself quite sufficient to make it indispensable to all teachers. No teacher need do his duty in fear and trembling after reading chapter xxi.

This completes the cheaper edition. In the fuller one we have an appendix of over two hundred pages, consisting of the actual text of the many Acts of Parliament regulating education in this country.

By no means the least valuable section of the book is its excellent index.

To all concerned in the administration of education we unhesitatingly commend this volume.

GEORGE BELL AND SONS.

Selections from Cicero. Edited by Joseph F. Charles, M.A. This little book comprises seventeen extracts from Cicero, nine of which deal with events which had an important bearing on his own life, or which show him as he described himself. One letter is included, as an example of his epistolary style, and seven anecdotes illustrate the range and variety of his narrative. The text follows Baiter and Halm's edition of Orelli. An introduction gives a short life of Cicero. The illustrations are numerous and good. The notes are careful and not too elaborate. Prose exercises are adapted to the text. There is a good and full grammatical appendix. Besides an index of proper names, there is a complete vocabulary.

Stories of Great Men, from Romulus to Scipio Africanus Minor. Edited by the Rev. F. Conway, M.A. This is a first reading book, designed to present a continuous line of famous Romans. Livy affords most of the extracts, but Florus and Velleius Paterculus have also been drawn on. There is an account of Hannibal's vow and death from Cornelius Nepos, and the story of Scipio's dream is taken from Cicero. While some of the extracts are printed verbatim, others have been condensed and abridged. An introduction deals briefly with Roman hero-worship and national character, the kings, the early republic, M. Furius Camillus, the war with Pyrrhus, Rome and Carthage, the East, M. Porcius Cato, P. Cornelius Scipio Africanus Minor. As in other books of this series, there are notes, exercises, an index of constructions and idioms, an index of proper names, and a vocabulary. The illustrations include a map of Italy.

Fables of Phædrus: A Selection. Edited by the Rev. R. H. Chambers, M.A. About half the fables of Phædrus are given in this selection. It forms a book of easy verse which may be read before Ovid, Horace, and Vergil. Phædrus is studied in German schools for his easy, fluent, pointed style and correct Latinity. An introduction tells the little that is known of the life of this author, and discusses, first, the nature of fable; and second, the relation of Phædrus to it in particular. The notes deal briefly with questions of grammar and translation. Twelve exercises consist of short English sentences adapted to the text, to be turned into Latin. There is a complete vocabulary.

Vergil: Æneid, Book VI. Edited by J. T. Phillipson, M.A. This is a clearly-printed edition of the sixth book of the *Æneid*. The notes are good and full. There is an index of the chief grammatical constructions, together with a complete vocabulary. The introduction contains sections on Vergil's life and works, the *Æneid* and an outline of its story, Hades, Vergil's theory of the universe and transmigration of souls, difficulties of translation, metre. Several of the illustrations are taken from the Vatican Vergil.

Horace: Odes, Book III. Edited by A. Latter, M.A. This edition of the third book of the *Odes* is based on those of Orelli, Page, and Wickham. An introduction gives a brief account of the life of Horace, his poems, the *Odes*, and the metres used in Book III. The notes are good and clear. There is a grammatical index, together with an index of proper names and a complete vocabulary.

The Student's Dynamics: comprising Statics and Kinetics. By G. M. Minchin, M.A., F.R.S. Professor Minchin has treated his subject in a very able manner, and his book will be of great assistance to students. The subject of dynamics always seems to present special difficulties to the average student; it is apparently a difficult matter for such to obtain anything approaching to clear notions. The fault may be due in many cases to the philosophic statements which are to be found in many text-books, and which are really intelligible only to a comparatively few students. Any such faults cannot be urged against the book under notice, in which the various parts of the subject are explained in the clearest possible manner.

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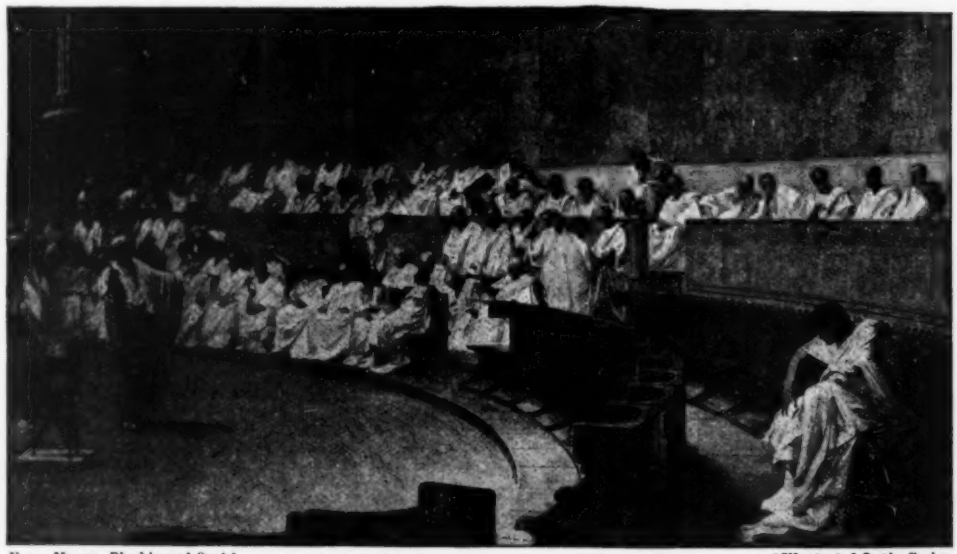

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tion over the columns of the Panthéon occur to us as we write, "*Aux grands hommes la patrie reconnaissante.*" At this distance of time the French people will now include the cardinal as one of the greatest of their great men. His faults were many, but he secured for his country power and place in the front rank of European nations. Dr. Perkins, who brings the highest qualifications to his work, has produced a volume that should find a place among any private or public collection of historical and biographical works. There are a number of exceptionally good illustrations, a map, and a thoroughly serviceable index.

RELFE BROTHERS.

Metric Weights and Measures, with an Appendix on Decimal Coinage. By J. Lingham Lees, B.A. This little book of seventy-two pages is designed to give accurate ideas of the decimal system as applied to weights, measures, and coinage.

The matter is clear and well arranged, and has evidently been worked out by one who understands the needs of pupils. The examples are numerous and well graduated—a feature of the book which we consider most valuable. The only page whose value is questionable is that on equivalents (page 43). It seems a pity to burden the pupil with such exercises as turning kilometres into miles, or square metres into square feet. The money examples are excellent. The answers are at the end. We think the book will be distinctly serviceable.

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Manual of French Pronunciation and Conversation, and Key to the Cours de Français. Part I. By James Child. The author of this book has attempted an impossibility, with the usual result. French pronunciation cannot be taught by books. The remark in the preface, "After all, the sounds of the human voice, no matter in what language, can be phonetically dissected," may be true, but it does not follow that English contains all these sounds. In fact, on the very first page he admits that "the letters Q and U have no comparative sounds in English."

There are many remarks to which exception might fairly be taken—for example, "The accent in single words is practically always on the last syllable." This is hardly so, and in such words as *notre*, *votre*, etc., it is clearly wrong. The pronunciation of *Deux* is given as *duh*, *long* as *long*, *poche* as *poh-sh*, *chambre* as *shaumbr*.

THREE NEW ATLASES.

The London School Atlas. An Atlas of General Geography for use in schools. By H. O. Arnold-Forster, M.P., M.A. (The London School Atlas Company, La Belle Sauvage, Ludgate Hill, London.) Great strides have been made during recent years in the art of atlas-making; and the *London School Atlas* is bound to take a place in the front rank, for it is a beautiful and extremely serviceable work. The principles which have been kept in view in the preparation of this school atlas are—1. It must be scientifically correct. 2. It must be well executed, and attractive in appearance. 3. It must be sufficiently full, and yet not over-full. 4. It must afford instruction in the science of geography. These principles have been faithfully carried out, and the work will satisfy the needs of every grade of school. Much care and good judgment have been bestowed upon the question of names, and the pages do not wear that overloaded aspect which is so common in some atlases. History has not been forgotten, and places such as Marston Moor, Crecy, Ivry, Tinchebrai, Plassey, are not only put in position, but the dates of the battles accompany them. Altogether, there are forty-eight pages of maps, and when we state that they include portions of ordnance survey maps with full explanations, and also a reduced example of an admiralty chart, etc., it will be understood how thoroughly the work has been done. For the most important countries two maps are supplied, one giving the physical, and the other the political details. These are placed in juxtaposition, and form one of the best features of the book. A novelty in connection with the atlas is the map of the environs of some large city or town. There is already a Manchester edition, and other towns may have map 7 replaced by a local one if called for. This will be very helpful in school excursions.

We think that map 7 would be better uncoloured. It is deprived of its clearness by the number of small green patches representing parks, woods, etc. Map 22 is a beautiful production, and extremely clear; it might have had cotidal lines inserted without interfering with its usefulness. The note to the first illustration on p. 6 has "lenght" for length, and on map 36 "Khart" is put for Khartum. The term Orange River Colony shows that the maps have been brought right up to date. We think that Canada, Australia, and South Africa have scarcely received their full measure of treatment. In future editions this will probably be remedied.

The Sphere Atlas. Political, Physical, and Commercial. (The Sphere Atlas Company, Limited, 7 White Hart Street, E.C.) This atlas amply fulfils all that its authors claim for it. Its fifty-six pages are filled with valuable maps of a truly educational character. A marked feature of the work is the absence of the usual border to the maps. We agree with the authors that borders often mislead young students, and the scheme introduced here of replacing the usual black border by a white one, in which the figures of latitude and longitude are plainly marked, will doubtless serve its purpose, and prevent misconceptions. It is, however, so unusual, so different from the ordinary traditions of atlas-making, that we shall take some time to get used to it. Another important feature of the book is the prominence given to the fact that each portion of the earth's surface dealt with is a part of a sphere.

On all but the political maps the height of the land is shown by distinctive colours. The physical features are remarkably well shown, and pupil-teachers particularly will find the atlas useful in following their lecturers, and in preparing their memory maps.

The atlas is, on the whole, well arranged. Five or six pages of illustrations are devoted to introductory matter; these pages will be found very useful for young children in public schools, and also in the home-school by those working with a governess.

The maps of river-basins include the Danube, Rhine, Thames, Mississippi, Ganges, and Nile. They are among the best we have seen. That of the Danube on p. 13 might, however, have been omitted, as the same ground is covered on p. 33, and again on pp. 36–7. The small maps showing the entrances to our English ports are especially good; and the commercial map of the British Isles on p. 16 is excellent. The industrial map of England on p. 21 is not a success; the idea is a good one, but the distinguishing colours for separate manufactures are not clear enough.

Almost every part of the world is well represented, but we think the Australian colonies might at any rate have received as full treatment as, say, the Transvaal on p. 49. The atlas should have a good sale.

Philip's London School Board Atlas. (George Philip and Son, London.) This atlas of thirty-six pages, which contains over ninety maps and diagrams, is a good effort of an eminent firm to keep pace with the times. It would be a difficult matter to put a better book on the market at the price. Some half-dozen pages at the beginning are taken up with statistical tables. These are extremely useful at times, but they belong rather to the geography text-book than the atlas, and we would rather have seen some of these omitted, and instead, a fuller representation in the way of maps of some important regions of the world.

The maps, as a whole, are beautifully executed, and fulfil in every respect educational needs. The map of the County of London is one of the best we have seen; and among others of exceptional merit we wish specially to mention the maps of Central and South Africa, Spain and Portugal, France, Italy, South-West Asia, South-East Asia, British North America, and the United States. That of the Thames basin is beautifully executed, but its value would have been enhanced if the river had not been hidden by county boundaries. The plan of the school neighbourhood, and the map illustrating geographical terms, are both distinctly good. We cannot say the same of the railway map, for the trunk lines cannot be distinguished. It would have been better if the page had had four separate maps, with one or two trunk lines on each. Most of the subsidiary maps are very effective and informing, and constitute a useful feature of the book.

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In Far Bolivia: A Story of a Strange Wild Land. By Dr. Gordon Stables, R.N. Here we have a tale of a country that is little known, by a writer whose works are much prized by boys throughout the English-speaking world. Many parts of the strange wild land of Bolivia are yet unexplored, and little is known of the savages of this country. It is to this unknown land that we are taken, where we follow the exciting adventures of the heroine, Peggy St. Clair, her cousin Roland, and her lover, Dick.

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For Full List of Illustrated Contents see Page lxviii.

one cannot help regarding the ducking of Alphonse (chap. xix.)—sneaking and eavesdropping notwithstanding—and yet more the manner of its relation, as a blemish in the book; so, it seems to us, is old "Duff" the coast-guard. He might very rightly have been named duffer. The coast guard of the south coast are generally men from the navy, chosen for good conduct; men in the prime of life, and not at all likely to be too ready to give information to "inquirin' and intelligent" "young forringers."

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Tom's Boy. By the author of *Laddie*, etc. The author will perhaps forgive us for suggesting that the title might well be inverted, and turned into "Boy's Tom;" for although Boy is a most interesting little fellow, it is Tom who holds the reader's sympathy from start to finish. The book will rank among the season's best gift-books. It is well written and ably illustrated. We cannot resist making the following excerpt: "He felt even in death he would sleep the sounder and sweeter with those mellow old bells ringing his lullaby, and the soft shadow of the great yew tree falling like a blessing on the mossy turf."

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If for this charming character alone, *The Beauforts* deserves a wide circle of friends.

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Our boys will read with interest the story of Antholin de Sabra, whose father was so long under a cloud, his school life and adventures in America, his being kidnapped and sent to England, his escape to France, and afterwards to America, when the whole mystery which enveloped his father was satisfactorily cleared up. The author keeps his secret well until the right time, maintaining the interest page by page until the end is reached.

HACHETTE ET CIE.

Le Mystère de la Chauve-Souris (Gustave Toudouze). To the host of story-books dealing with the Napoleonic era the author has added another, and one that we think should be widely read. The plot is very carefully and thoughtfully woven. Interest is awakened at the very outset. The sombre picture introducing the first chapter is typical of the mystery that pervades the whole book. We hurry from chapter to chapter eager to follow the fate of the persons introduced to our notice. The stage upon which the play is acted is that part of France known as Brittany. There is plenty of romance and of love; there is, too, a clear undercurrent of that superstition which is perhaps always a more potent factor in the life of the inhabitants of Latin countries than with us. The book is most luxuriously got up. The printing is exceedingly well done, and the illustrations are good. Altogether, it is one of the choicest prize volumes we have seen this season. It would form an excellent reward for children in the upper classes of the ordinary secondary school.

Messrs. Hachette have also issued another volume in their charming series the *Bibliothèque Rose Illustrée*, entitled **Autour du Clocher**, by Julie Borius. This pretty story, profusely illustrated by M. Le Coultre, will make a very acceptable gift-book.

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Marian; or, The Light of Some One's Home. A Tale of Australian Bush Life. By Maud Jeanne France. The story of a girl's life is interestingly told, and has a healthy moral inwoven. The serious purpose of the authoress is best shown perhaps by giving her concluding words: "If but one heart through its quiet teaching has learned to discern a beauty in holiness .....if one young friend has found the paths of obedience are those of happiness, through the humble medium of the author's pen, her highest ambition is more than satisfied."

Girls in their early teens are the readers for whom the book is most suitable.

The Exploits of Miles Standish. By Henry Johnson. Mr. Johnson has done well in writing a very interesting account of the exploits of Miles Standish, based on authentic documents, where they exist. Where no information remains, the author has judiciously filled up the gaps with fictitious but highly probable history. The whole forms the kind of book which appeals strongly to the fancy of young readers, and, while furnishing them with excitement and enjoyment, puts before them a model worthy of imitation (for the hero, like some one else, was little but wise, and a terror for his size), and teaches them something of a very important stage in

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the history of our colonisation. We hope many of our young friends will read this book with the same amount of enjoyment as we have experienced in its perusal.

The Sheik's White Slave. By Raymond Raipe. The scene of this tale is laid in Arabia. An inscription on an obelisk outside the tomb of King Ptamos was, after much trouble, deciphered by the Arabs. It stated that the enormous treasures of the king could only be reached by a white youth, skilled in the ancient language of the people, and a slave of the great sheikh. To fulfil these conditions, Tom Inglis was carried off into the interior, and after having been taught the ancient language, was dispatched into the tomb to find its treasure and bring it to his master. For the many difficulties and dangers he had to surmount we must refer the reader to the book, which rivals, if it does not eclipse in excitement, the works of Rider Haggard.

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A Noah's Ark Geography. By Mabel Dearmer. Miss Dearmer gives us the further adventures of the Cockyolly Bird, which some of us learned to love last year in her book of Penny Toys. The small Kit, his favourite Jum-Jum, the Cockyolly Bird, and the Noah's Ark Polar Bear, meet with strange adventures at the North Pole, Japan, and elsewhere. The coloured pictures are bold and striking. The sketch of Kit counting the number of flowers on Miss Brown's white dress during the geography lesson is charming. "The animals argue a great deal, and are sometimes very rude in their remarks," was the comment of a small boy on hearing the story read aloud.

The Tale of the Little Twin Dragon. By Rosamond Praeger. This very comical tale is illustrated by many still more comical pictures of two dragons in impossible positions. We suppose the text is to be read to a child, as it seems in advance of the large, well-coloured illustrations.

This book, like so many others, appears to us to have a touch of the "Alice in Wonderland" idea.

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Bab's Baby, and Other Stories. By Katherine E. Vernham. This little volume contains a collection of ten storyettes. They are extremely interesting, although very pathetic, and cannot help having a healthful moral influence on young readers. The title story shows the affection of Bat Mason for Mrs. Panner's baby. *About Three Friends* is the longest, and perhaps the best, but *The Widow Man* is beautifully and pathetically written. The two full-page illustrations are by Gertrude D. Hammond.

The Fortunes of Peggy Treherne. By Annette Lyster. Peggy's mother having been left a widow, and failing in business, was obliged to seek a home for herself and Peggy in Plymouth Workhouse, where the mother dies. Peggy was a high-spirited but remarkably affectionate girl, and in her first situation, as maid of all work, became greatly attached to her gentle mistress, Miss Singleton, and Mr. Edwin. However, Peggy is taken from them by her rich uncle, who comes home from Mexico, and, ere returning, makes provision for Peggy to be brought up as a lady. She escapes the little plot for her marriage with Basil Copeland, and eventually marries Mr. Edwin. It is a brightly-written story, and our young readers will regretfully part from ingenuous and interesting Peggy. There are three full-page illustrations by W. S. Stacey.

Jonathan Toms. By A. V. Dutton. A pretty story, suited for elder children. Jonathan was an aristocrat spending a holiday in Switzerland. Of a remarkably retiring disposition, and not blessed with the usual amount of aristocratic advantages in face and figure, he excites sympathy from the start. Moreover, he had been disappointed. At Zurich he is struck with the charms and the force of character of *petite* Maisie Palliser, who is taking her parents for a tour in the Tyrol. How Jonathan attaches himself to the party, and finally wins Maisie, forms the material for a charming story. The grandeur of the mountainous Tyrol, and its historical associations, afford scope for many descriptive passages of good writing. The two full-page illustrations are by C. J. Staniland.

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After Worcester: The Story of a Royal Fugitive. By E. Everett-Green. The author has found in the pages of our nation's story sufficient material for a series of interesting and exciting tales which no one would call unromantic; and perhaps none of them deal with a more exciting episode than that of the flight of the second Charles after the fateful day of Worcester. In this new setting the oft-told tale loses none of its old charm: the heart of every boy reader will be thrilled by the hairbreadth 'scapes of the two young heroes and their master; and we doubt not that "full many a star-bright eye" will grow dim at the relation of the trials of the brave girls who risk so much for their king. The book is well illustrated by Mr. John H. Bacon.

Ships and Havens. By Henry Van Dyke. In this little book, human beings are compared to ships, and their aims in life to havens; the latter including work, pleasure, wealth, fame, character, and immortality. To each of these topics a chapter is devoted.

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ago or more. And the appearance of the printing, which looks a little like black-letter, with impressive parts underlined, and headlines and quotations in red ink, reminds one of an old rubric.

Adventurers All: A Tale of the Philippine Islands in War Time, by K. M. Eady, is a spirited and exciting narrative of the adventures of Evan Williams, an English lad who is second mate on the *Annabel Lee*, a vessel engaged to carry arms to the insurgents in the Philippines during the recent war of independence. The book is full of fascination, and will delight elder lads and give them fresh matter for thought. The cause of the difficulties that arose between the Americans and the Filipinos is clearly and fairly explained, and much interesting information given. The print and illustrations are good.

Gunpowder Treason and Plot, and Other Stories for Boys, by Harold Avery, Fred. Whishaw, and R. B. Townshend, is a collection of seven amusing stories, well illustrated and nicely bound. The print is good—a very important matter in these days, when young eyes are worked so hard, and spectacles are so common on childish faces.

Although these little tales are professedly "for boys," yet it seems to us that they will equally delight girls of like age—say about eleven years and upwards.

Craddles, by Alice Knight, is a very interesting little story book with plenty of pictures, and will be eagerly read by boys and girls alike from eleven or twelve years to almost any age.

The coloured frontispiece and the little figure on the cover seem to us somewhat too youthful in design for the text, but perhaps we are hypercritical.

The tale relates the doings of three schoolboys, who are sent into quarantine before going to their homes, measles having broken out in their school. They stay in the house of a trusty old servant who lives by the sea. The lads have a delightsome time, winding up with a grand adventure, in which they show plenty of wit and pluck.

A Little Ray of Sunshine. By Jennie Chappell. This is a splendid child's story, and we hope, in the interests of the rising generation, that it may be widely read. Like Charles Kingsley, Miss Chappell can write a religious book without making it "goody," tedious, or unnatural, and we congratulate her on an achievement so rare.

Her little heroine Mousie and the dear doll Mirabelle will be favourites in the nursery, and many a youngster will take nobler views of Christian life from this loving yet practical little tale. The "get up" of the book is very attractive.

Up the Creeks: A Tale of Adventure in West Africa, by Edward Shirley, is a capital gift-book for a boy of any age beyond ten or eleven years. The "get up" of the book is excellent, and the tone of the story plucky and thoroughly patriotic.

Trentham, the hero, is a lad of seventeen or eighteen, who is in the employ of a company trading on the west coast of Africa. His efforts to do his duty to his employers speedily bring him into disfavour with the black workmen, who join with a neighbouring chief of very evil repute, and Trentham finds himself attacked in his own house.

A series of adventures follows which taxes the hero's courage to the uttermost, but, as in the good old fairy tales, all ends well.

Life of General Gordon. By M. B. Synge. This is a desirable little book, printed in good, clear type, and contains a portrait of Gordon, with views of some of the scenes of his labours and travels, together with a map of Eastern Africa from Victoria Nyanza to the Mediterranean. It is also prettily bound, and will form an excellent gift-book of the smaller kind.

A Terrible Feud, etc. By E. Velvin and E. L. Haverfield. This is a collection of seven short stories for young children. The little story tells of the quarrel between Mabel Torrington and Jack and Harry Benham, and the reconciliation, owing to the manly behaviour of the boys. *Anton Horner* is a sweetly pathetic little story, the scene of which is laid in Switzerland. *A Terrible Scrape* shows how easily little boys get into mischief, and the trouble and anxiety caused thereby. The Irishisms of Bridget are very diverting in this story. But they are all good, and teach the beauty of self-denial and inculcate self-reliance.

My Lady Marcia, a story of the French Revolution, by Eliza F. Pollard, is a long story, yet the interest rarely flags. The author has studied her subject carefully. Lafayette, Danton, Robespierre, Tallien, Madame de Fontenay, are some of the historic personages with whom we come in contact in the course of the story. Its opening chapters are very pleasing. The journey of little Lady Marcia with her father, Lord d'Arcy, to the grand French chateau of the Marquis de Brosse, where Lord d'Arcy's sister lives, or rather reigns, as "marquise;" the meeting of brother and sister, and the giving in charge of little Marcia, Lord d'Arcy's only child and spoiled pet, before he himself goes to fight Washington, are very prettily told. On Marcia's French bringing-up the whole story turns. Her father falls in battle, and Lafayette, then fighting under Washington, sends the news to the chateau, and Lady Marcia afterwards knows no home but that of the marquis and his wife. Yet Lady Marcia is a great heiress, and when trouble comes her English money is freely used to help her relatives; but, even more than money, her English coolness helps them in the awful days of the Revolution. The story will prove of great fascination to many young readers.

A Book about Longfellow. By J. N. M'Ilwraith. Miss M'Ilwraith has a genuine enthusiasm for Longfellow, and has told the tale of his lofty, amiable, and serene life with much grace and charm. A wide circle of readers will find this book a delightful companion to the poet's works.

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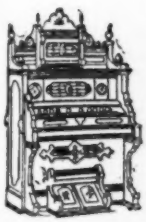

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